McGraw-Hill Publishing Company, Inc.

September, 1934

Construction Methods

DUAL-DRUM PAVING MIXER and gas-electric finishing machine lay 20-ft. lanes, 40-ft. concrete paved relocation of Pompton Turnpike for New Jersey State Highway Depart...

Asphalt Plant—Central Bitulithic Company, Buffalo

Construction Methods

McGraw-Hill Publishing Company, Inc.,
330 West 42nd St., New York

ROBERT K. TOMLIN, Editor

SEPTEMBER, 1934

WILLARD CHEVALIER, Vice-President

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Registration for Skilled Labor

● Harry O. Locher's article, "What the Codes Mean to the Construction Industry", in the June issue of *Construction Methods*, has elicited the following comment by one of our readers, a resident engineer for one of the state highway departments:

"There is an imperative necessity for improvement in the construction industry and if all of the individuals involved will cooperate by means of the code regulations it would be a great step ahead. I suspect that the worst offenders, the smaller contractors, will be the hardest to control. The personnel which is employed by these smaller units is rather low in the scale of proper intelligence to appreciate what the code means and the attitude of so many of them is antagonistic.

"There is some justification of their attitude in view of the PWA regulations which are combined now with the code regulations on highway work. The regulation which requires the use of local labor on these contracts has been working a hardship on them which is difficult to deny. If the condition requiring the use of local labor could be adjusted to permit the contractor to carry his skilled men with him and use local common labor, the situation and attitude of the contractors would be much improved.

"In regard to this skilled labor and to the foremen engaged in construction work, I believe that the Code Authority could provide a splendid service to contractors if it would install a system of registration for these men somewhat on the principle that a large Eastern construction company has used in its work. In this system, each man is given a record-of-service book which entitles him to preferred employment on any of the company jobs. When the man reports for work the superintendent notes the date on which the man began work and when the job is finished. If the man's work was satisfactory, he again signs the book, giving the date on which the work was stopped. I believe that such a system could be worked out on a national scale for the construction industry which would include superintendents, foremen and skilled laborers in particular. The records of the men and the quality of their work could be collected by the Divisional Code Authority and in this way the general quality of the men in charge of work could be materially improved.

"It is almost pitiful to watch contractors turn over their money and equipment to some of the men we encounter on highway construction and I believe that the key to the situation in a good many cases lies in obtaining or providing men of reasonable intelligence and integrity, with some appreciation of ethics, to take active charge of the work."

Marcus, in The New York Times

The Way It Always Ends

First Area Agreement For Mason Contractors

● Under the provisions of the Construction Code the first area agreement on wages and hours to be completed between the mason contractors and their bricklayer employees in Greater New York and certain adjacent territory was signed by President Roosevelt last month. This agreement, expected to be the first of a series of such contracts to be approved under the NRA, provides for a rate of pay of $1.50 per hour for regular hours, except on three-shift work, for which the second and third shifts are paid at the rate of eight regular hours' pay for six actual hours of labor. For overtime, the rate is double that for regular hours. The only overtime possible to be worked under the agreement is that occurring in cases involving danger to life or property, and on work that cannot be done during regular hours with safety or without serious inconvenience to others.

The agreement became effective on Aug. 13. It terminates Feb. 28, 1935, or sooner if the mason contractors division of the construction code becomes ineffective before that date.

Code Observance

● A complicating factor in the early functioning of the Construction Code and of divisional codes such as that of the General Contractors' is the ignorance of certain government departments regarding the code requirements. As an example of this lack of cooperation between the National Recovery Administration and certain other divisions of the Federal Government, one may cite the disregard of bidding regulations on certain projects. The General Contractors' Code states that no alternate bid shall be received from one bidder unless the same opportunity is offered to all bidders. On at least one job, an important branch of the Government permitted one bidder to propose a number of alternates, with complete prices for each plan. These unsolicited alternate bids were not immediately thrown out; instead, the awarding authority gave them serious consideration.

Although too much cannot be expected at once in getting all the numerous Government departments in step with the requirements of a new code, an earnest effort to put all government work in line with NRA code regulations is necessary if contractors are to retain confidence in the Government's purposes. In a case like the one cited, the awarding authority must either refuse to consider bids not conforming with the original proposal or must reject all bids and call for new bids on the entire list of acceptable alternates. By the first procedure, the government would give evidence of whole-hearted support of the code. By the second, it could comply with code requirements and obtain the lowest price for the work.

The Resident Engineer-Inspector

● On the whole, the Public Works Administration deserves to be commended on appointing to the many projects which it is financing resident engineer-inspectors who are experienced in construction and who are just and reasonable in enforcing regulations governing labor, materials and accounting procedure. In most cases, the state PWA authorities have discharged creditably the heavy responsibility of placing on the various projects men who measure up to the requirements for a resident supervisor. Their success in most instances serves to emphasize their failure in a few.

Unjust or unreasonable interpretations of the PWA regulations by the resident engineer-inspector can cause a contractor no end of annoyance and loss. A resident supervisor to represent the interests of the Public Works Administration is necessary and desirable on every PWA project. But it should be recognized that the inspector constitutes one more official overseer whose requirements must be met by the constructor before any estimates can be paid. In this capacity he easily can become a disturbing and delaying factor in the work.

It is the duty of state PWA engineers to keep in mind the critical importance of the resident engineer's position in selecting men to fill these posts. In addition to honesty and technical knowledge, a man must have tact, construction experience, and the ability to judge fairly if he is to qualify as a good resident engineer-inspector.

Economy that *May* Devour Profits

RECENTLY a contractor bid in a municipal works job. As he was about to begin work it developed that he planned to rely almost wholly on old equipment, some his own and some rented from another contractor.

It happens that one of the taxpayers of that city is a construction man, competent to appraise the practical worth of such plant. So he notified the contractor that if any attempt were made to use some of the worn-out equipment he would lodge a protest with the authorities and do his best to have it condemned.

If this taxpayer makes good on his promise the contractor may find himself, at the very least, in for some troublesome and costly delays, with the further possibility of added costs for repairs or reconstruction that might wipe out any anticipated profits. *In the long run he may find that he actually has paid for new equipment without having got it.*

This writer is in no position to judge the merits of that case, but he wonders how many contractors are flirting today with similar opportunities for loss. Before they decide to defer the purchase of equipment they really need to carry on satisfactory and profitable construction, they will be wise to take into account such costs as these.

It is quite possible, moreover, that this taxpayer may have more than a mere nuisance value; he may in fact be advocating a course that would be to the contractor's best interest.

Everyone connected with construction knows that the last few years have taken heavy toll of the contractors' resources; no other class of producers has taken more severe punishment. So this is no suggestion that these hard-hit men should squander their meager resources foolishly or buy beyond their real needs. To advocate that would be silly and unfair.

Rather is this intended as an appeal to the contractor's self-interest. It is simply a reminder that, in the matter of production plant, measures of economy may easily be carried to the point of extravagance. For some years now, many contractors have had good reason to sit tight and make things do. With little work in hand and less in sight, they naturally have been reluctant to invest in new equipment.

But today the outlook has changed. As this page recently pointed out, the prospects for a continuous construction program are brighter than they have been for a long time; the indications are that they will become even brighter. Alert contractors know, therefore, that they now may count on a reasonable use of their new plant. Many of them are buying accordingly.

But the man who still follows too closely the "make-it-do" policy of recent years is taking a long chance. Every job that is taken today is not only a possible source of immediate income. It is also an opportunity to rebuild reputation with engineers and awarding officials. So the forward-looking contractor wants to make sure not only that he earns his profit but also that he delivers an acceptable job without too much fuss and wrangling.

If he is going to risk curtailed output, breakdowns, (with spare parts not always so quickly available as in other days) delays, condemned work and costly repairs, he is in danger of wiping out his anticipated profits and of having nothing to show for them when the job is finished. It is quite possible also that before he does finish it, he may have to buy the new plant anyway.

Certainly this sort of performance will not build up with those for whom he works the kind of goodwill that makes for favorable working conditions in the future, the kind that every wise contractor seeks to cultivate.

On the other hand, judicious investment in up-to-date and efficient plant may insure the realization of his profits and the creditable completion of the work in hand. And with that completion, the contractor will have on hand equipment that will enable him to figure his next job more closely and earn its profits more easily. The time has come to resume the strengthening of productive capacity, which is the backbone of profitable contracting. This cannot be done by clinging to the depression-bred practice of pushing outworn equipment beyond its effective life.

This matter must be dealt with by every contractor on its merits and in accordance with his own judgment and resources. This is merely to suggest that each such decision take full account of all the factors that changing conditions are bringing into the problem.

Willard Chevalier

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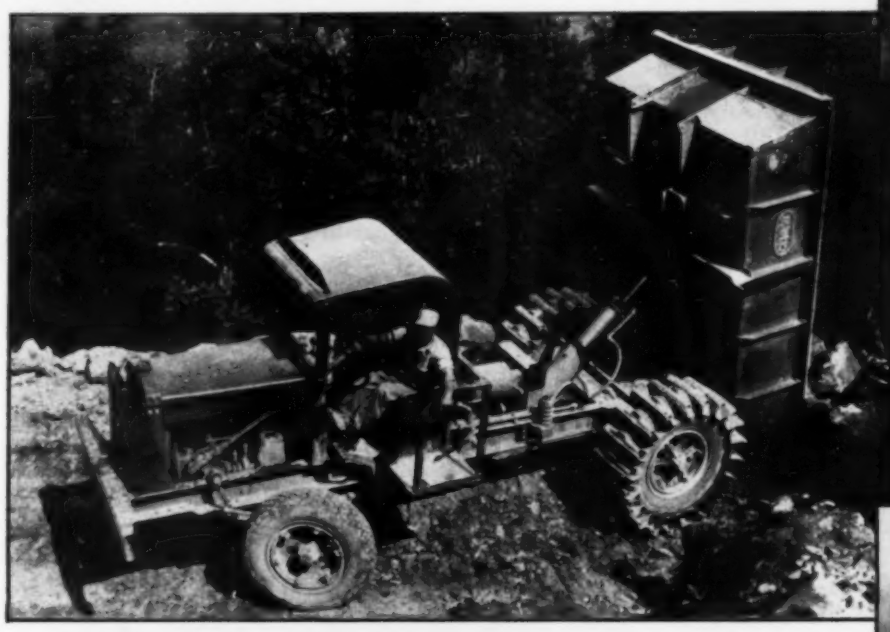

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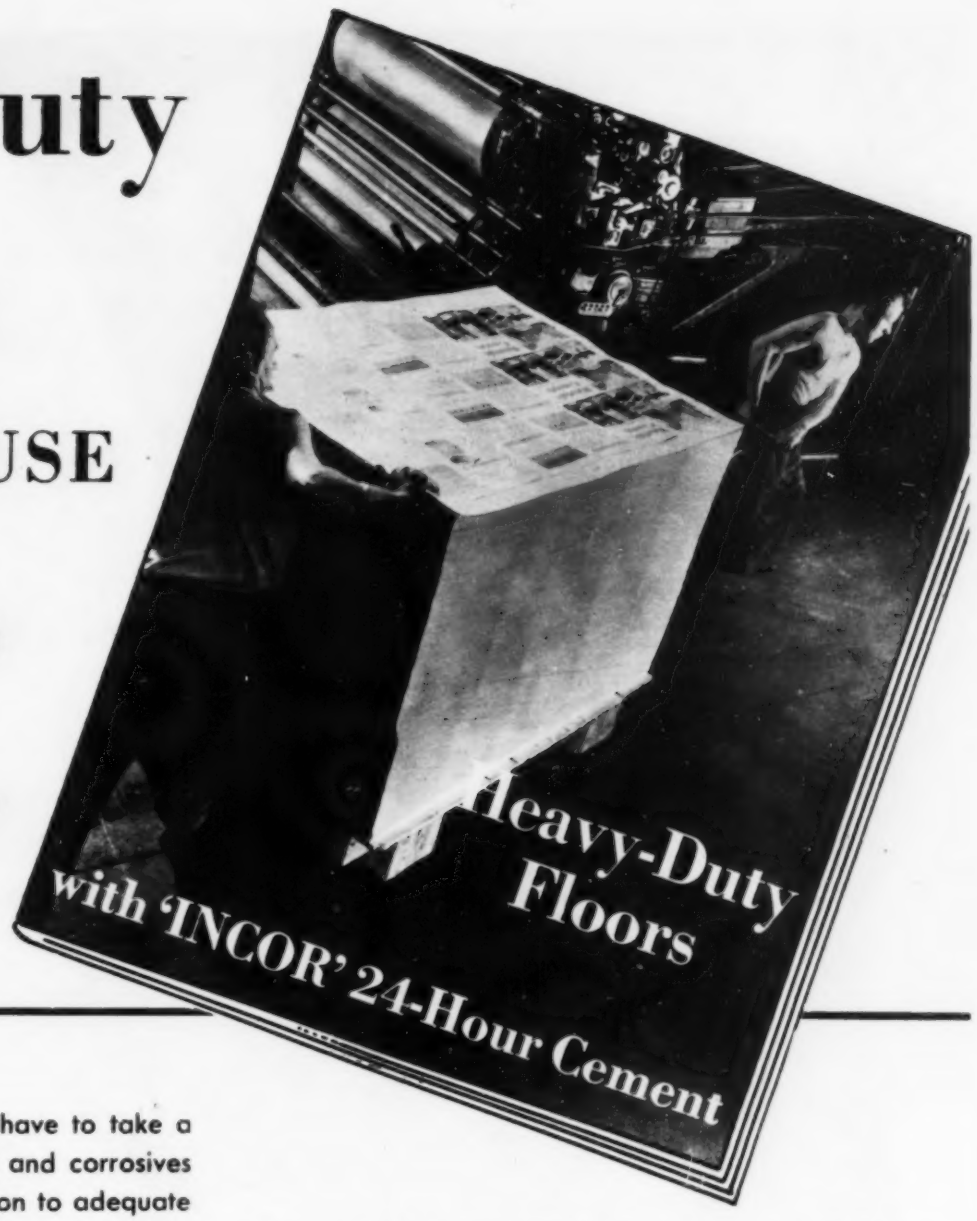

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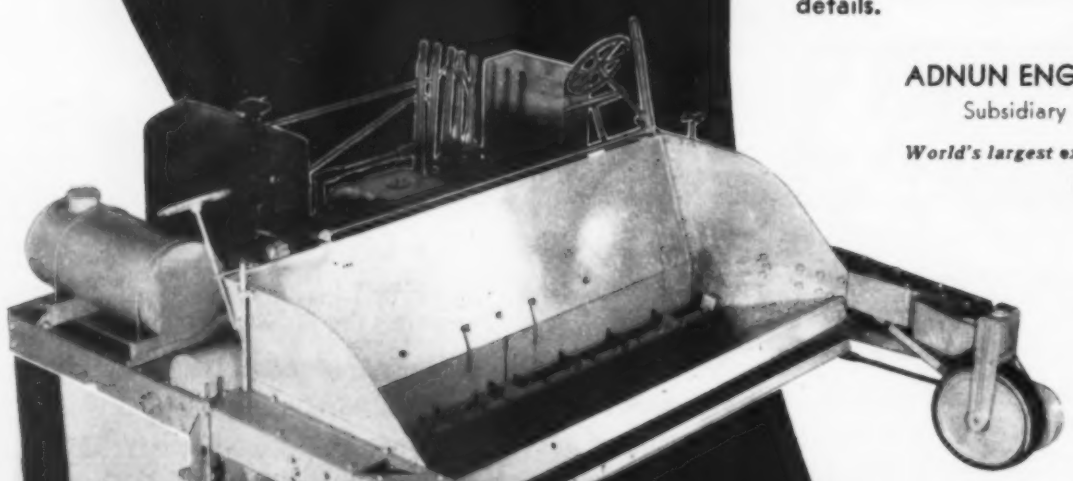

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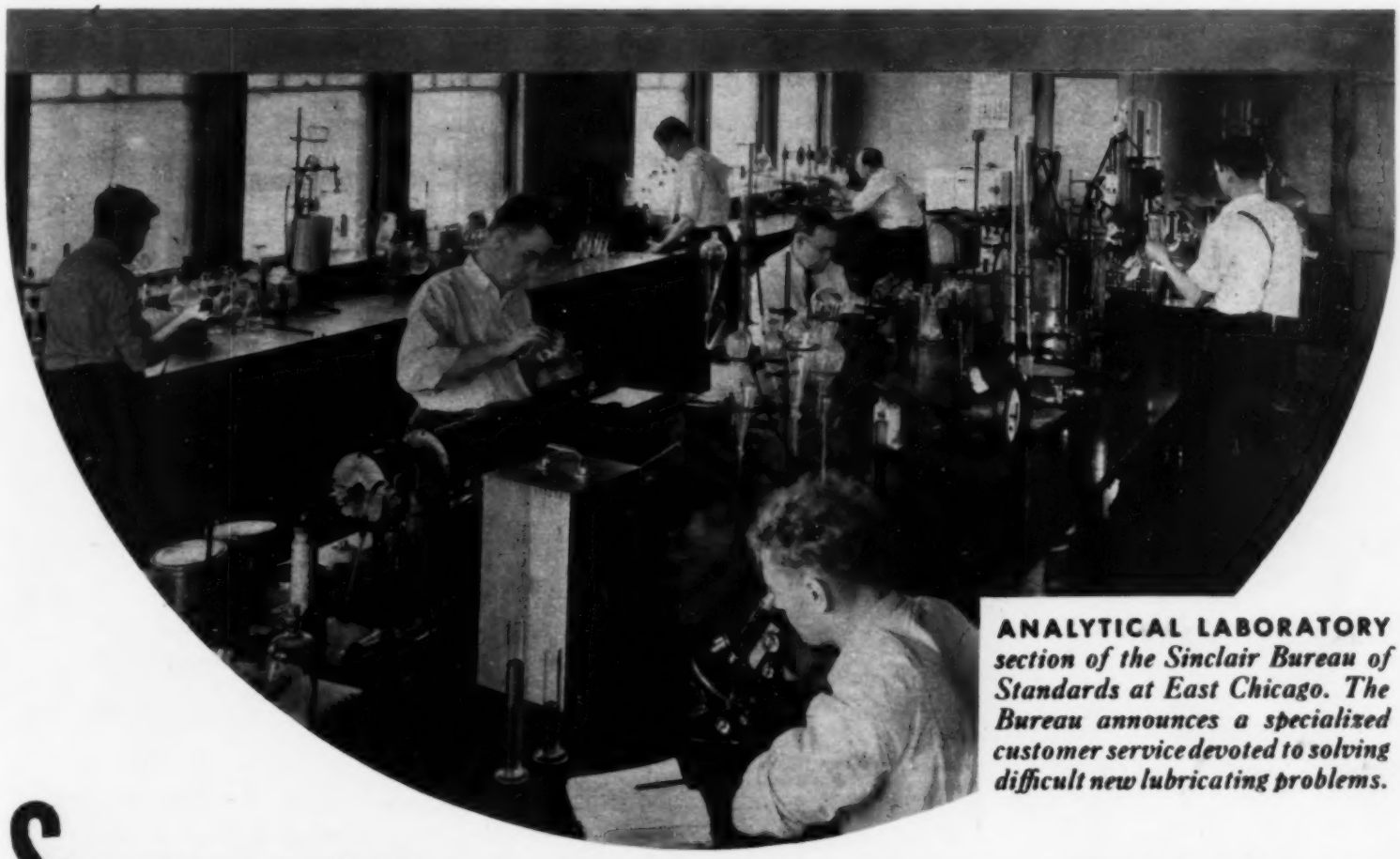

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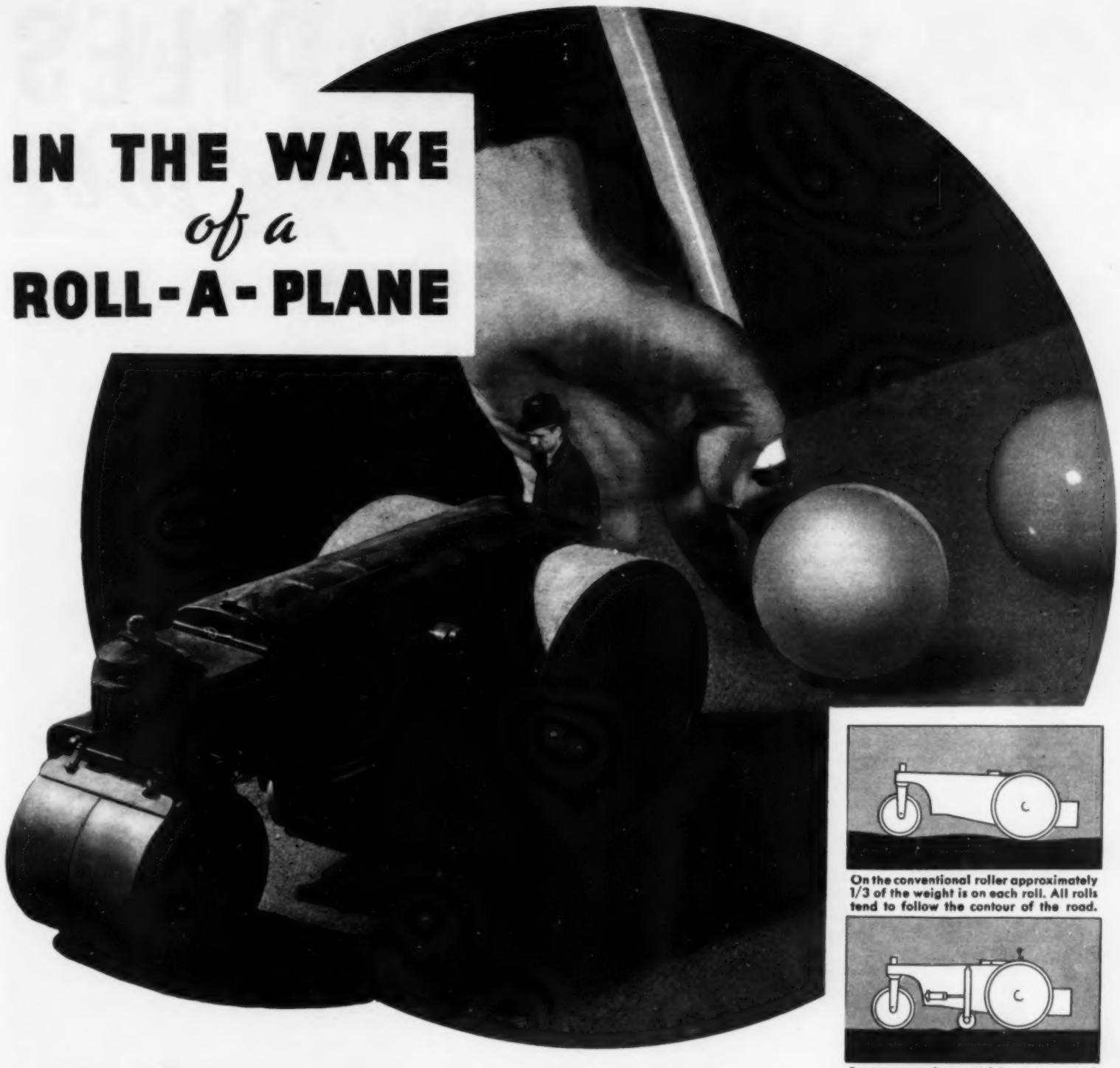

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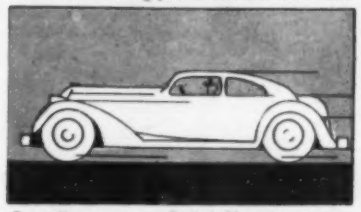

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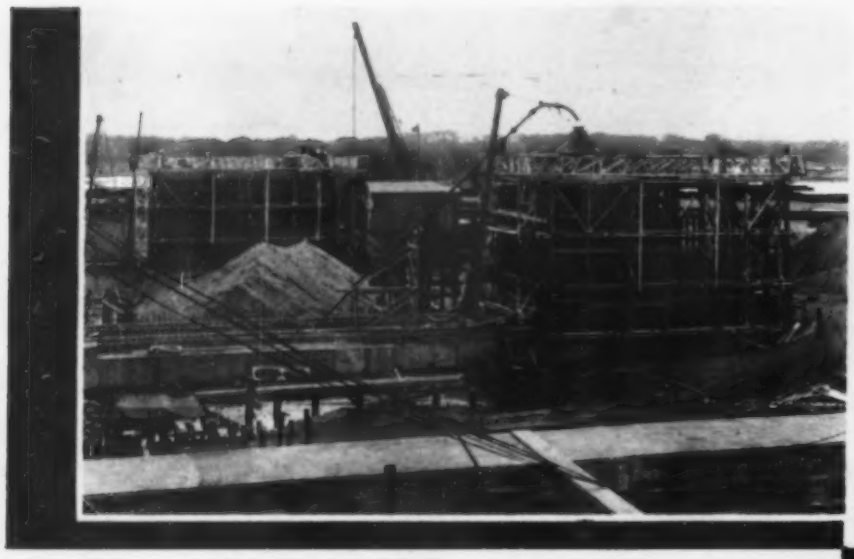

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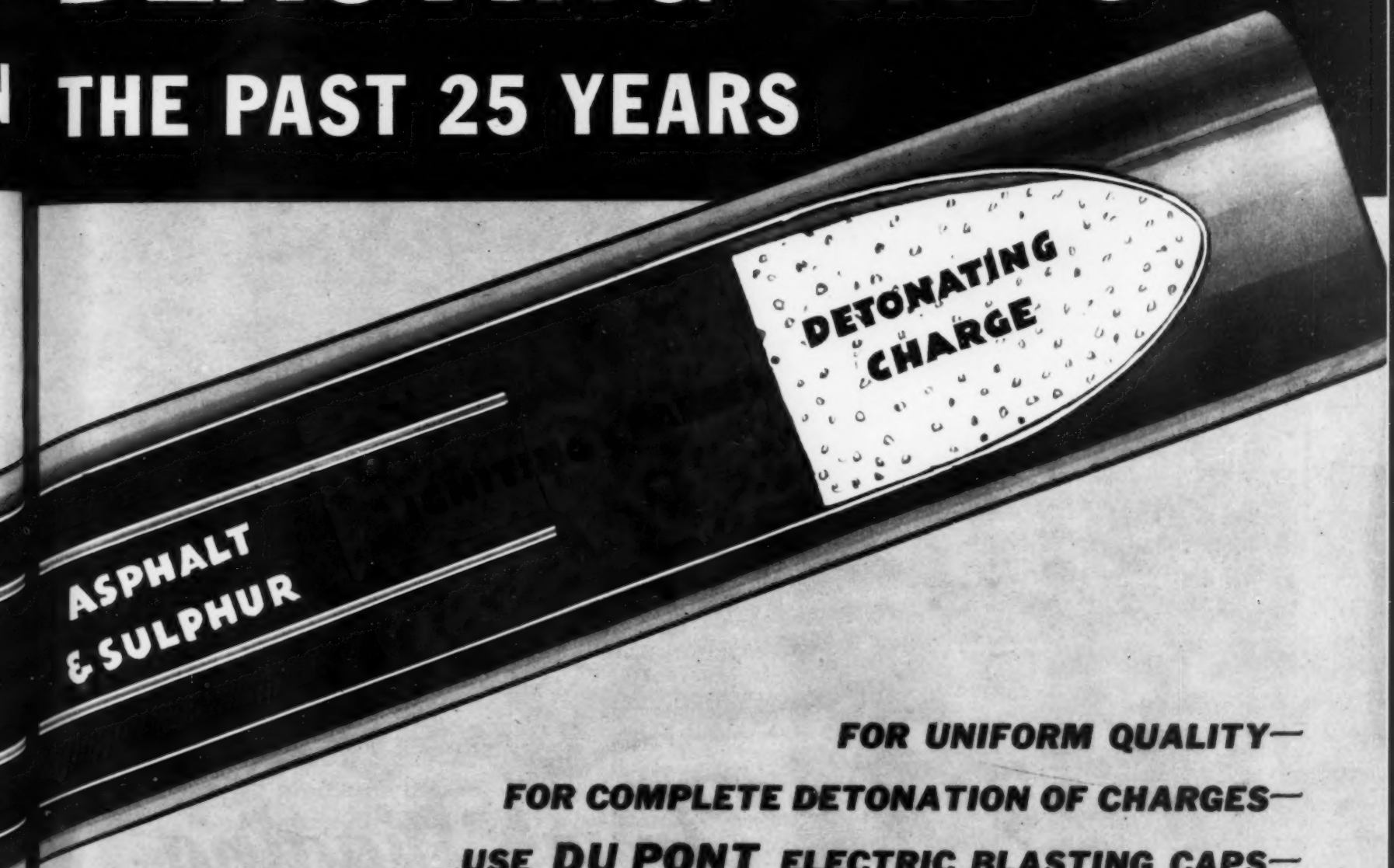

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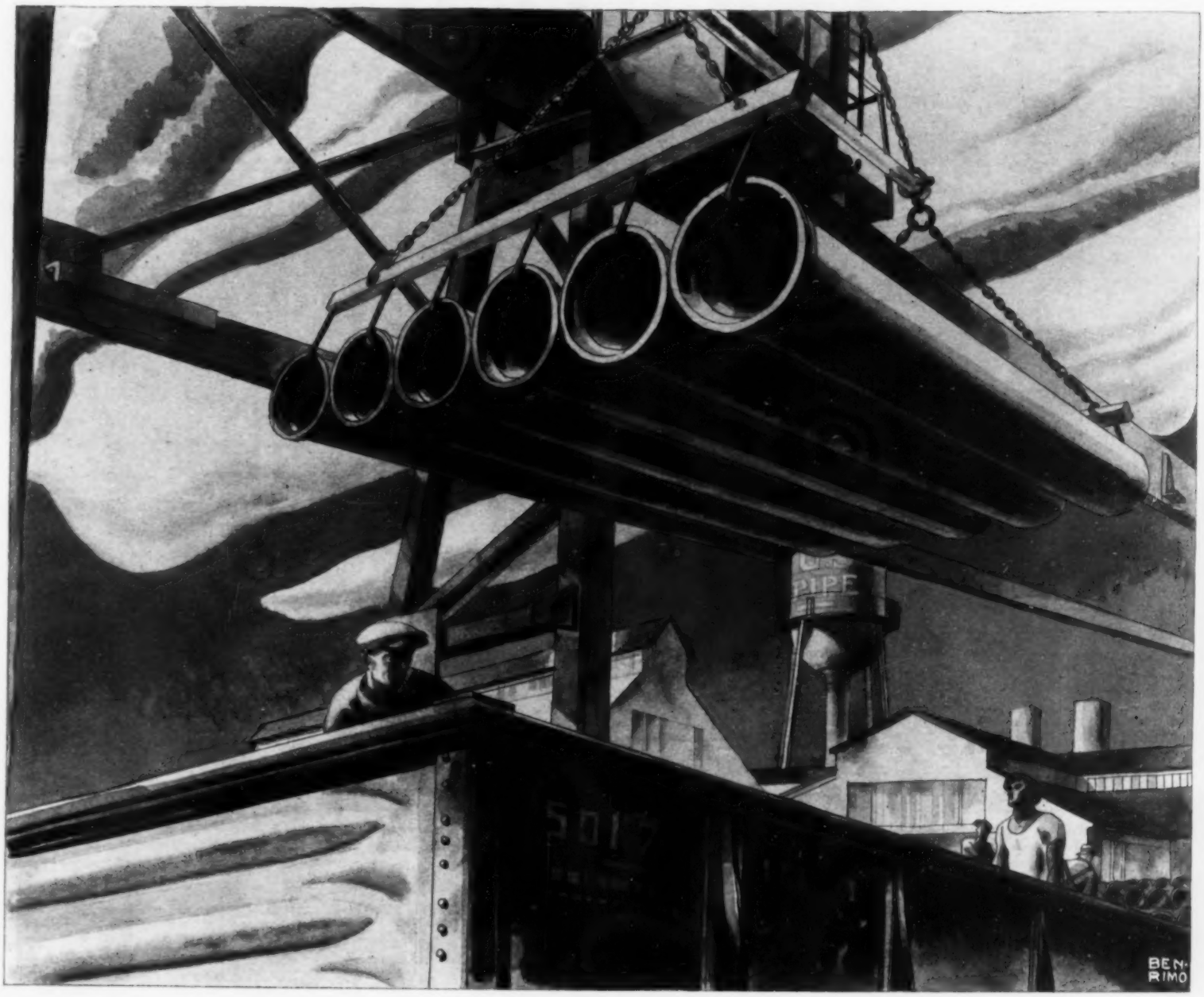

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There's one thing about white portland cement stucco—you can get just the right color to fit the structural and architectural design and to bring out the full beauty of the texture used. On this Los Angeles office and factory building, architect John M. Cooper wanted a clean, light, smooth exterior finish—neat and business-like. Using *Eclipse Stucco*, a prepared stucco (which is preferable), plastering contractor Howard A. Booher did the job pictured above.

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ATLAS WHITE PORTLAND CEMENT

PLAIN OR WATERPROOFED

Construction Methods

ROBERT K. TOMLIN, Editor

Established 1919—McGraw-Hill Publishing Company, Inc.

Volume 16—Number 9—New York, September, 1934

FIRST PENSTOCK SECTION, 30-ft. in diameter, is delivered to Government's heavy-duty cableway for lowering into canyon of Colorado River.

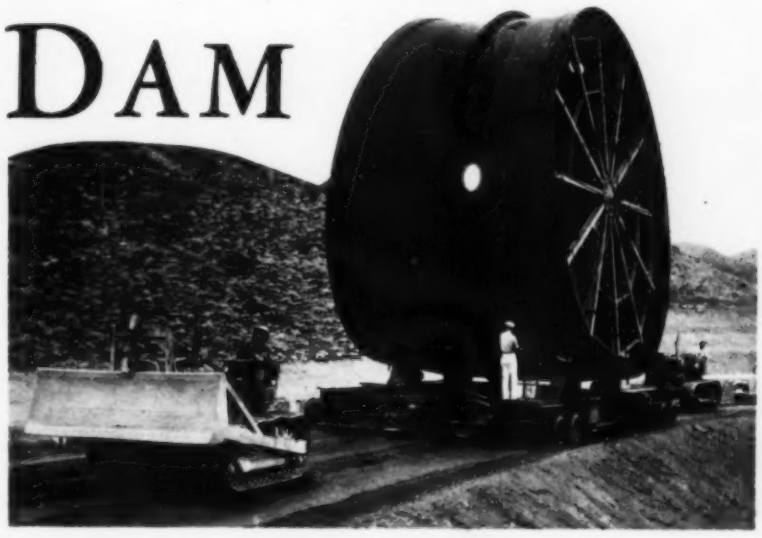
REINFORCING SPIDER is inserted in huge 30-ft. welded steel pipe to maintain its shape during trip from fabricating plant and down, by cableway, into canyon.

First 30-Ft. Penstock Section Arrives at BOULDER DAM

INSTALLATION of the heavy 30-ft. diameter fusion-welded steel pipe sections forming the penstocks serving the power plant at Boulder Dam was begun last month, marking a new stage in the construction of the U.S. Bureau of Reclamation's $165,000,000 project in the Black Canyon of the Colorado River. Under an $11,000,000 contract The Babcock & Wilcox Co. is fabricating at a special field plant, erected about 1½ mi. from the canyon rim, 45,000 tons of steel penstock pipe in sizes ranging in diameter from 30 ft., with a plate thickness of 2¾ in., to 8½ ft., with a plate thickness of ⅜ in.

The 30-ft. diameter pipe to be installed in tunnels connecting with the power plant, is fabricated in so-called erection-sections consisting of two rings, each 12 ft. in length, electrically welded with a fillet-insert section between them, to form a unit about 24 ft. long. Each ring, in turn, is fabricated from three 32x12-ft. by 2¾-in. steel plates, each plate weighing 23 tons. A completed erection-section of 30-ft. diameter penstock, using plate of maximum thickness, weighs about 170 tons.

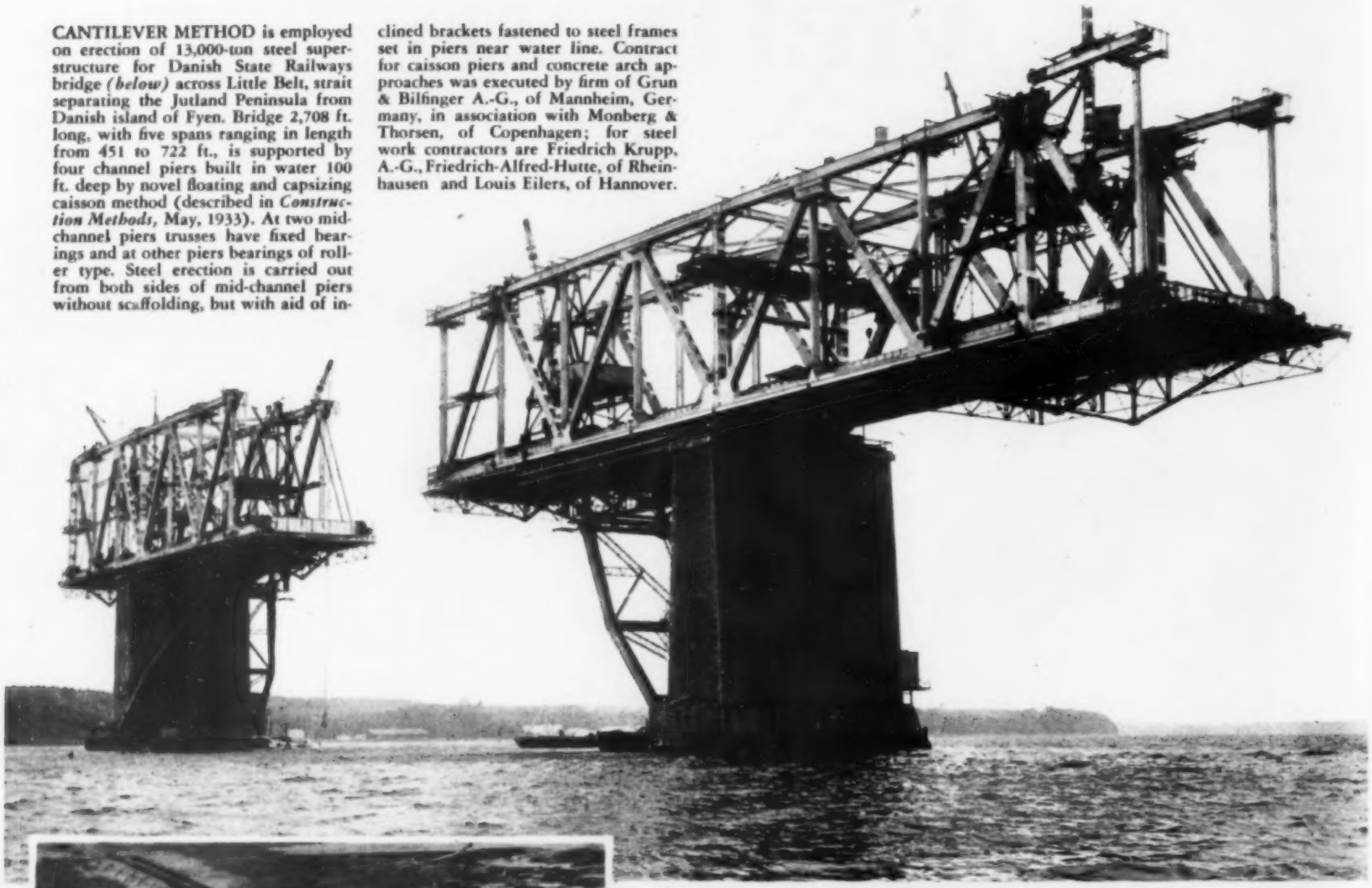
These heavy sections, after the shop welds have been inspected by X-ray equipment, are transported to the job on special tractor-hauled trailers, as illustrated herewith. The pipe sections are there picked up by the Government's heavy-duty 185-ton cableway, crossing the canyon below the dam with a clear span of 1,256 ft. This cableway lowers the pipe 600 ft. to platforms for transfer through adits leading to the concrete-lined penstock tunnels.



SPECIAL TRAILER of 200-tons capacity, hauled by tractor, transports penstock erection-sections to Government cableway across canyon. Trailer has 16 wheels on axles, and weighs 41 tons.

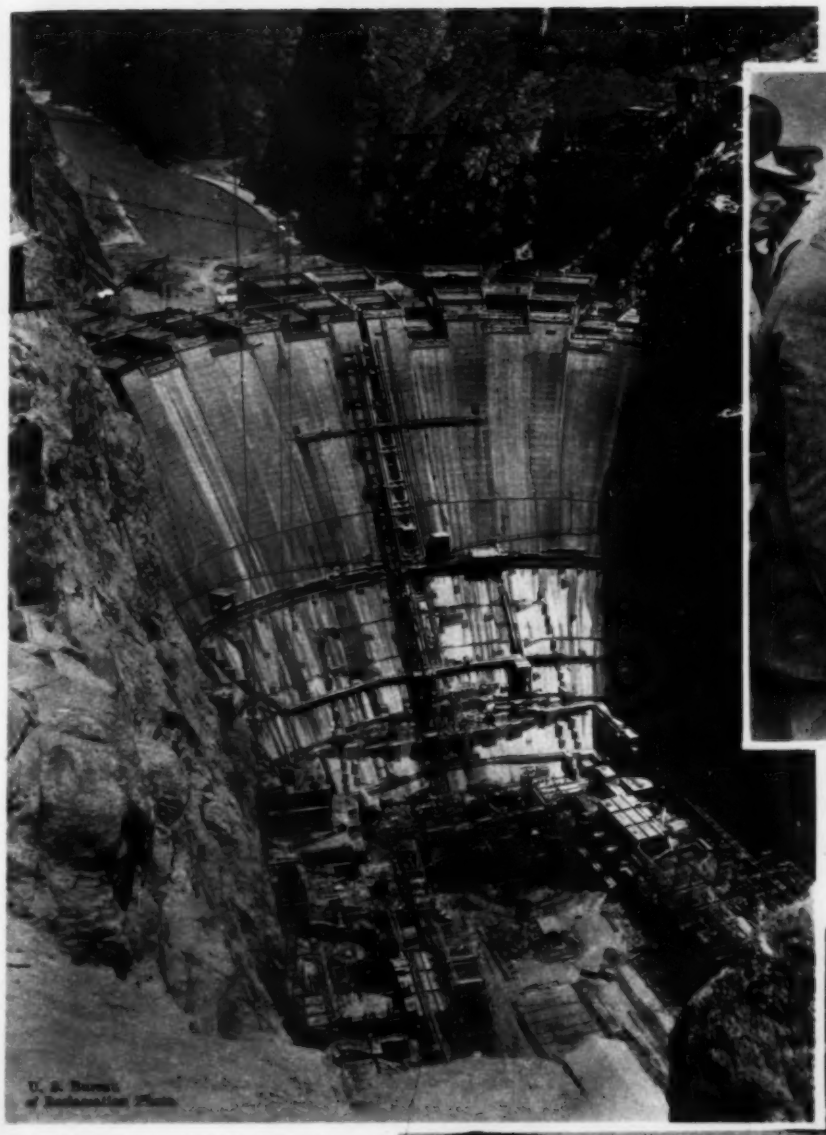
This Month's "NEWS REEL"

CANTILEVER METHOD is employed on erection of 13,000-ton steel superstructure for Danish State Railways bridge *(below)* across Little Belt, strait separating the Jutland Peninsula from Danish island of Fyen. Bridge 2,708 ft. long, with five spans ranging in length from 451 to 722 ft., is supported by four channel piers built in water 100 ft. deep by novel floating and capsizing caisson method (described in *Construction Methods*, May, 1933). At two mid-channel piers trusses have fixed bearings and at other piers bearings of roller type. Steel erection is carried out from both sides of mid-channel piers without scaffolding, but with aid of inclined brackets fastened to steel frames set in piers near water line. Contract for caisson piers and concrete arch approaches was executed by firm of Grun & Bilfinger A.-G., of Mannheim, Germany, in association with Monberg & Thorsen, of Copenhagen; for steel work contractors are Friedrich Krupp, A.-G., Friedrich-Alfred-Hutte, of Rheinhausen and Louis Eilers, of Hannover.

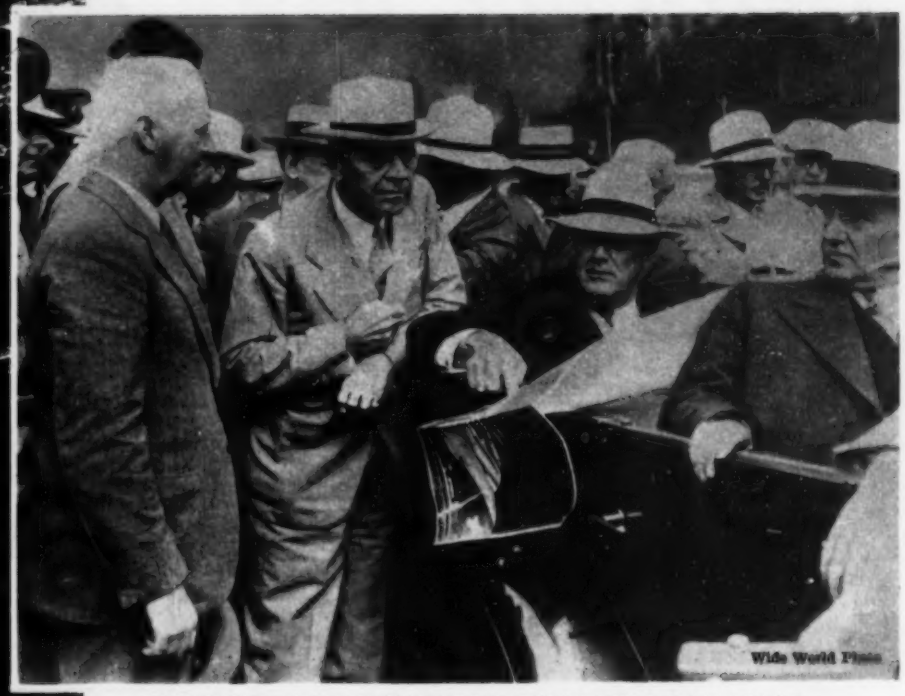


NEW 5-MI. CAUSEWAY, involving six bridges over navigable channels, is being built by Long Island State Park Commission from Freeport, N. Y. to Jones Beach State Park, popular seaside resort. View shows concrete pile supports for bridge and (at left) casting yard for piles ranging in size up to 24 in. square and 95 ft. long (as further illustrated in the "Details" department of this issue).

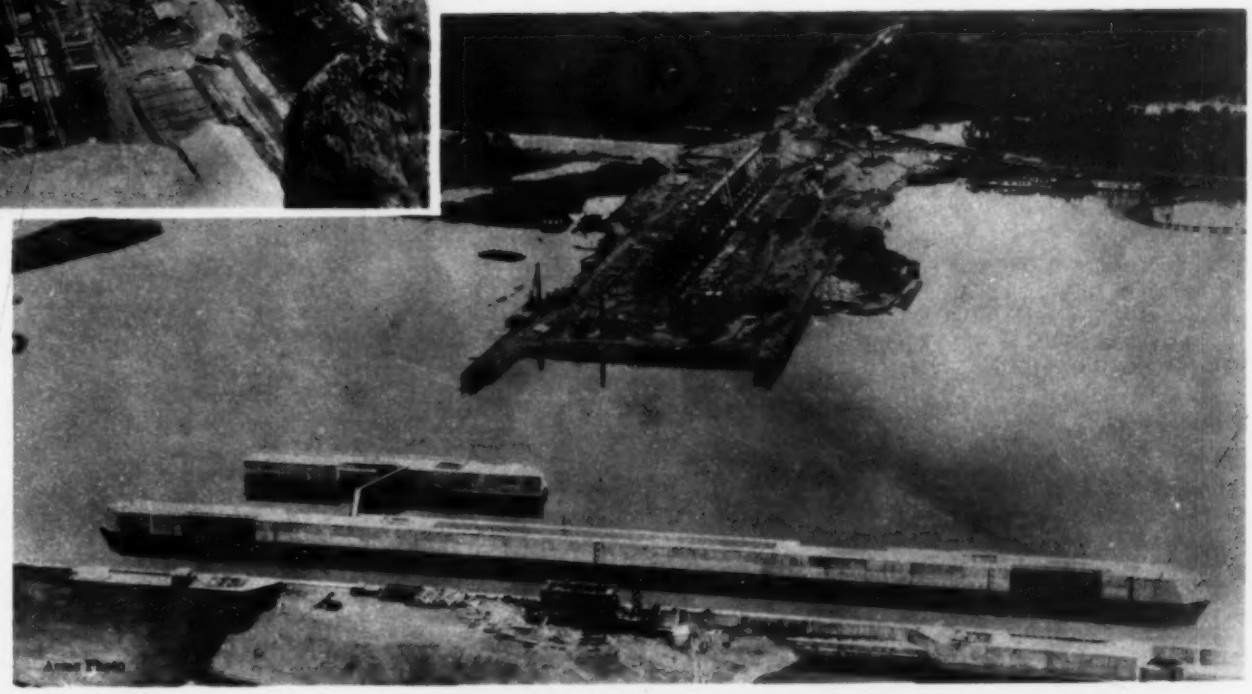
WORK STARTS ON ALL AMERICAN CANAL *(below)*, **$27,000,000 project with length of 130 miles which will carry, for irrigation purposes, water from Colorado River below Boulder Dam at point near Yuma, Ariz., to 500,000 acres of farm lands in Imperial Valley of southeastern California.**



U-SHAPED POWER PLANT takes form inside cofferdam at downstream toe of Boulder Dam. Main structure in Black Canyon of Colorado River, to be 729 ft. high when completed, is shown with forms topped out at Elev. 955, or 450 ft. above lowest concrete in cutoff trench.



PRESIDENT ROOSEVELT INSPECTS BONNEVILLE DAM. Chief Executive studies plans for $30,000,000 Oregon-Washington power and navigation project on Columbia River. *(left to right)* Col. T. S. Robins, Pacific division engineer, U. S. Army; George Dern, Secretary of War; the President; and Governor Julius Meier, of Oregon.



UPPER MISSISSIPPI CANALIZATION. *(right)* Lock and dam No. 5 at Whitman, Minn. will provide 9-ft. channel between Twin Cities and St. Louis. Under Corps of Engineers, U. S. Army, lock *(in foreground)* was built by E. F. Gillen Co., Milwaukee and dam costing $1,800,000 is under construction by Merritt-Chapman & Whitney Co.

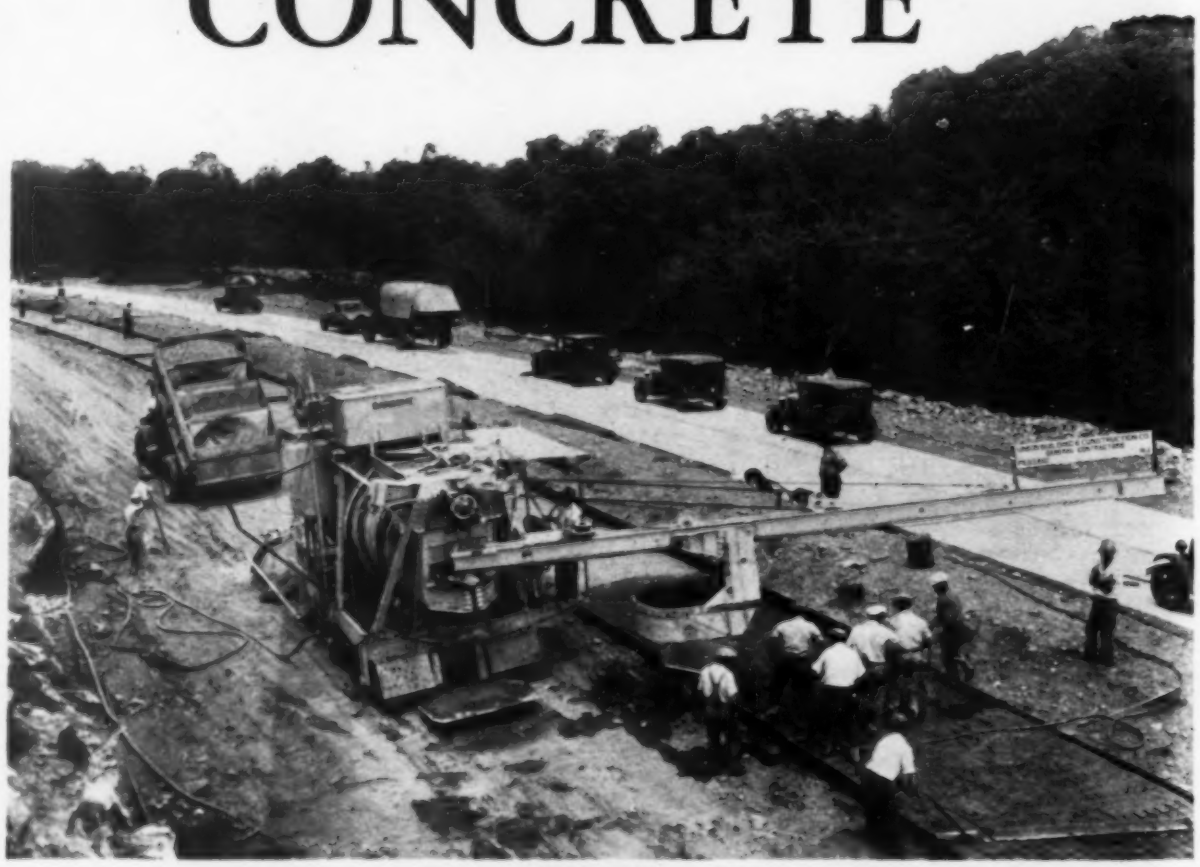
FIRST P. W. A. HOUSING PROJECT COMPLETED. One of small blocks of houses erected at Alta Vista, Va., by limited dividend corporation, operating under supervision of Public Works Administration. These homes rent for from $16 to $20 per month.

Four-Lane Jersey Highway Built With

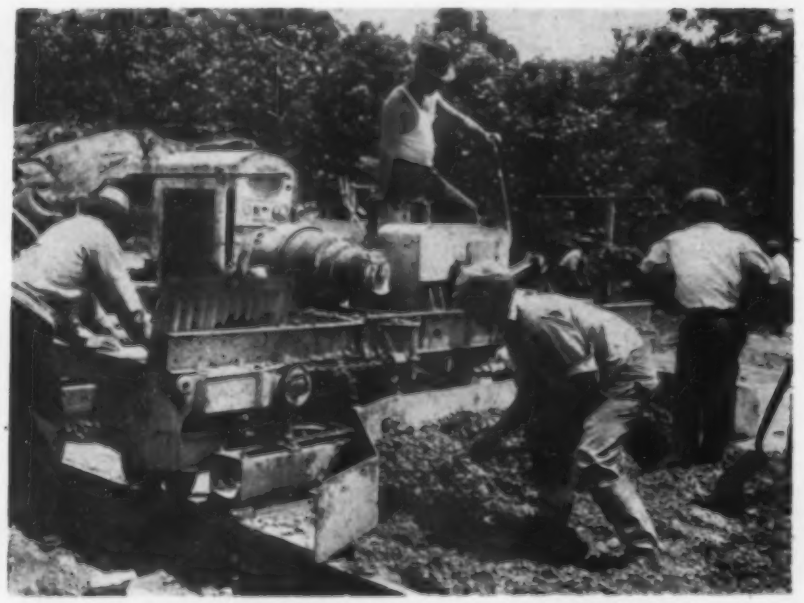
DUAL-DRUM PAVER and VIBRATED CONCRETE

BUTLER CUTOFF, showing 4½-mi. relocation of state route No. 23.

SEVERAL innovations in method and equipment for concrete road building under New Jersey state highway specifications have been introduced on a 4½-mi. relocation, near Butler, N. J., of the Pompton Turnpike (State Route No. 23, Section 13-A), the main highway extending from Newark northwest to Sussex, near the New Jersey-New York State line. The new cutoff, providing four 10-ft. wide, concrete paved traffic lanes divided into pairs by a 16-ft. central "island" or grass-surfaced strip, eliminates three railroad grade crossings, two bridges over the Pequannock River, bypasses the towns of Smith Mills, Butler, Bloomingdale, and Riverdale, and provides easy curves as contrasted with the kinks on the old route. From the construction viewpoint the outstanding features of the work being done for the New Jersey State Highway Department (Major W. G. Sloan, state highway engineer) by the Union Building & Construction Co., of Passaic, N. J., under a contract amounting to $362,000, are: The use of a dual-drum paving mixer; a gasoline-electric, instead of the usual gasoline-powered, finishing machine; vibration of concrete slabs, and along transverse and longitudinal joints, with an air-driven spud-type vibrator; curing the concrete slabs with wet cocoa matting covered with rubber sheeting to retard evaporation; new types of waterproof transverse and longitudinal joints; and the marking of integral stripes to guide traffic by dusting white cement upon 6-in. wide bands of the freshly laid concrete along the edges of the slabs.



DUAL-DRUM PAVER, equipped with 25-ft. boom, deposits concrete within forms for 10-ft. strip of pavement while 4-compartment batch truck charges mixer skip.



GAS-ELECTRIC FINISHING MACHINE is powered by 23-hp. gasoline engine driving electric generator supplying current to motors.

Design of Pavement—The four 10-ft. wide slabs of concrete have a uniform thickness of 9 in. and are reinforced 2 in. below the finished surface by welded wire sheet fabric, supplemented along each edge at the ends of slabs by ¾-in. round marginal bars 10 ft. long, bent over 4 in. at each end. The mat steel is spaced 6 in. transversely and 12 in. longitudinally. The mats, each 12 ft. long and 9 ft. 6 in. wide, are laid to lap 12 in.

Joints — The concrete pavement is poured in slabs 56 ft. 4 in. long, separated by a special beam type of waterproof transverse expansion joint, assembled on the job, as illustrated here-

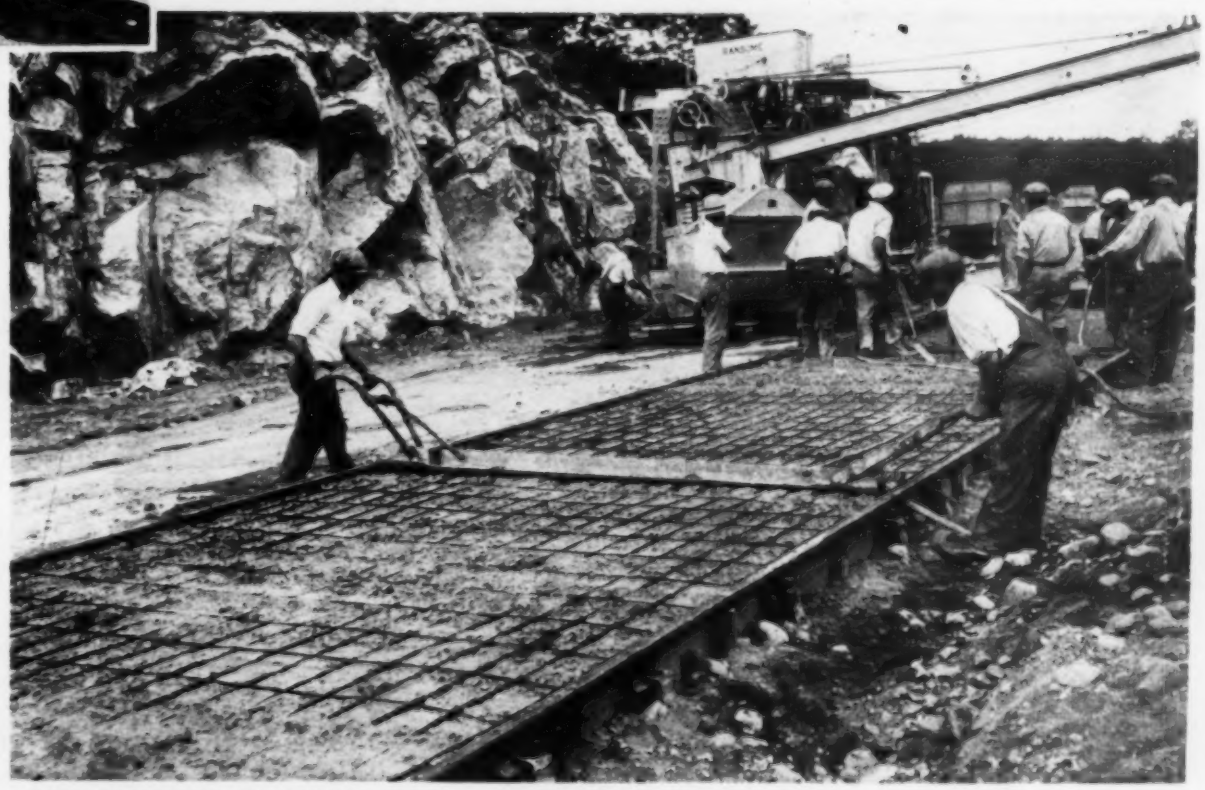
SPUD VIBRATOR, operating on air at 80-lb. pressure, consolidates concrete along joints with frequency of 3,500 vibrations per minute.

PREPARATION OF SUBGRADE is done with self-powered blade grader followed by hand shovel work and rolling.

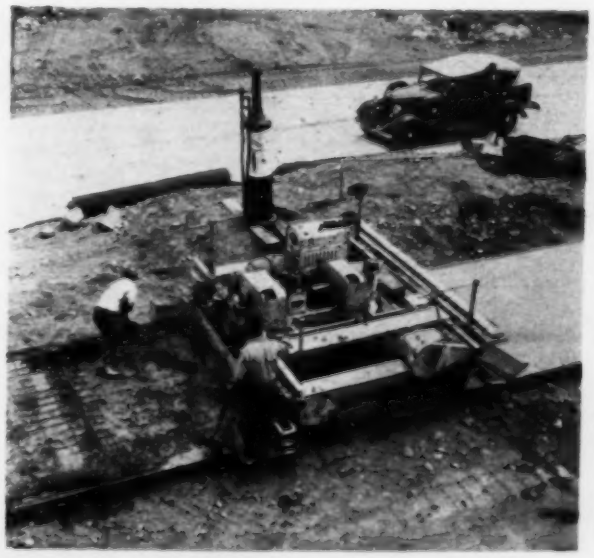
with. This joint, designed by Harold Giffin, is a steel frame which holds channel dowels rigidly in place. It consists of a ½-in. thick strip of 8-in. wide premolded bituminous joint material, with its top 1 in. below the pavement surface, punched with holes through which extend twelve 2x⅜ in., 2.18 lb.-per-foot, steel channel dowels, each 20 in. long, which are supported by a pair of 2⅛x1¾x¾-in. No. 12 gage channels, 9 ft. 10½ in. long, extending across the slab, one on each side of the joint, and carried by brackets held in place along the inside faces of the forms by special clamps. For a length of 10 in. each of the twelve 20-in. long channels, serving as dowels or beams between adjacent slab ends, are coated with hot asphalt to break the bond with the concrete in which they are imbedded. Over the top of the premolded joint material is placed a waterproofing strip in the form of an inverted U of No. 20 gage galvanized sheet metal. Four 1x1x⅛-in. angle irons, 9 ft. 11 in. long, are then placed above and below the dowel channels, tightened up with a special clamping tool and finally held in place by ten angle clips, five on each side of the joint, as shown in an accompanying sketch.

During concreting the waterproofing strip at the top of the joint is covered by a channel-shaped sheet metal protection cap which is removed by pulling up with a hook after the concrete surface has been machine-finished. The upper edges of the concrete at the joint are then rounded with an edging tool and the ⅜-in. deep groove above the top of the waterproofing strip is filled flush with bituminous filler.

Longitudinal joints between 10-ft. concrete slabs consist of a ½-in. thickness of premolded joint material capped by an asphalt-coated, galvanized sheet

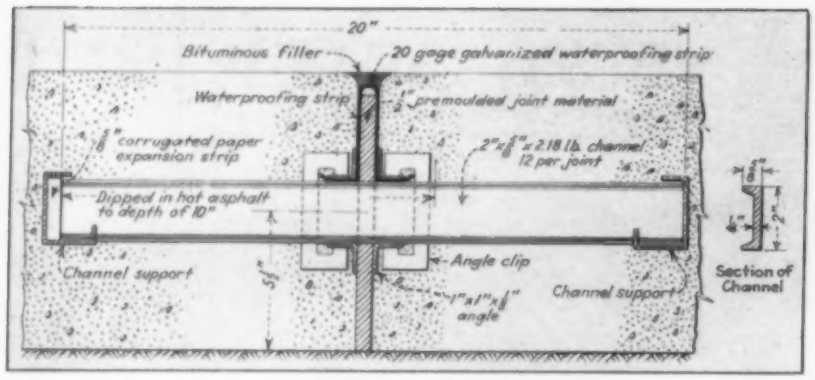


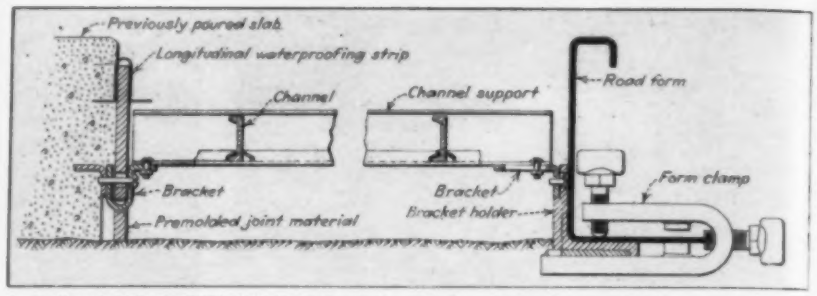
REINFORCEMENT of welded wire sheet fabric is placed 2 in. below surface of finished pavement and brought to proper grade by pounding with screed.



MACHINE FINISHING of pavement is done by gasoline-electric machines with finger touch control and four speeds both forward and in reverse.

ROBERT McCARTHY, general superintendent *(left)*, and LOUIS DRUKKER, vice-president and manager of Union Building & Construction Co.





TRANSVERSE JOINT DESIGN *(at left and above)* showing method of supporting beam type of channel dowels and waterproofing with galvanized metal strip.

Step-by-Step Method of Installing TRANSVERSE JOINT

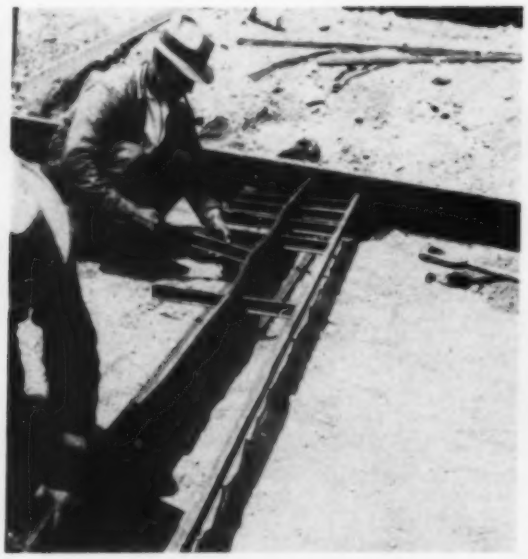
metal waterproofing strip (consisting of two pieces) with lower ends bent 90 deg. to extend 1 in. horizontally into the concrete and form a water seal.

Batching Plant—At a central batching plant along a siding of the New York, Susquehanna & Western R. R. at Bloomingdale, N. J., a couple of miles, by road, from the south end of the job, sand and crushed stone from a local quarry are loaded by belt conveyor into an elevated three-compartment steel bin, weighed and dropped into 4-compartment batch trucks for delivery to the mixer; cement is handled in cloth sacks, 7 bags per batch, and is added to the sand and stone at the loading skip of the paving mixer.

Mix—The concrete being used is a 1:1.75:3.42 mix, using coarse aggregate of two sizes. Voids in the aggregates amount to 46 per cent. Each weighed batch, requiring 7 bags of cement, consists of 1,236 lb. of sand, 1,164 lb. of ¾-in. stone, 1,164 lb. of 1½-in. stone. From 28 to 29 gal. of mixing water is used per batch.

Dual-Drum Paver—In order to in-

1 JOINT MATERIAL ready for assembly showing punched molded strip, angle iron and channel support with bracket on form in background.

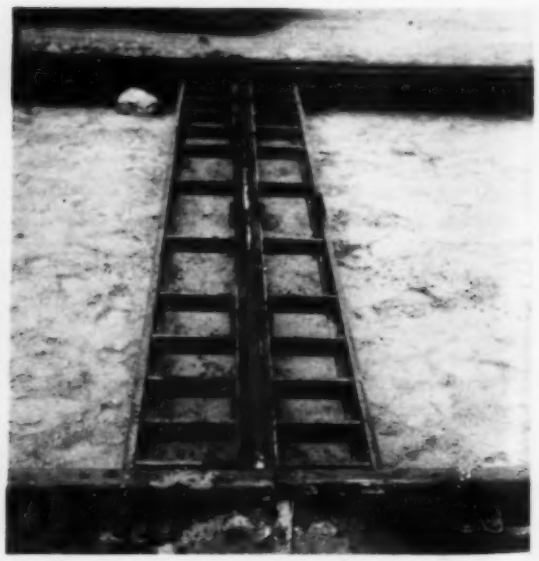


2 CHANNEL DOWELS are inserted through holes in premolded material and carried at end by channel supports.

3 STEEI FRAME completed, showing relation of channel dowels, channel supports, and premolded joint material.

4 WATERPROOFING STRIP is in place on top of joint to protect premolded material.

5 CLAMPING TOOL tightens up members which are held in place by angle clips, five on each side of joint.

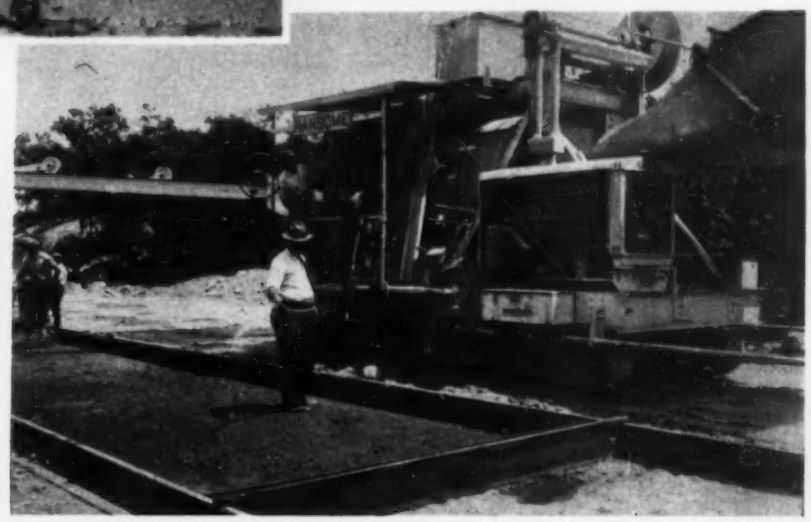


6 COMPLETED JOINT ASSEMBLY with metal protection cap, ready for the pouring and vibration of concrete.

crease concrete production beyond the limit possible with a standard single-drum 27E paving mixer the contractor installed a dual-drum Ransome paver powered by a 6-cylinder gasoline engine and equipped with a 25-ft. boom. In this machine two standard 27E size drums, each 5 ft. 6 in. in diameter and 4 ft. 8 in. long, are built end to end, with an opening between them equipped with a power-operated discharge chute to pass concrete from the first to the second drum. This arrangement allows two batches to be mixed simultaneously, each one spending about half of the required mixing period in each of the two drums. With the dual-drum paver four batches are actually in process at the same time: one in the loading skip, one in the first drum, one in the second drum, and one in the distributing bucket traveling out along the 25-ft. boom to its point of discharge on the subgrade. The paver is operated to concrete one 10-ft. lane of the pavement at a time, passing back and forth over the route for the succeeding lanes of the 40-ft. paved width.

EDGING TOOL *(left)* rounds off joint corners before metal protection cap is removed.

LONG-HANDLED FLOAT is applied to paved surface in wake of finishing machine.



SUBGRADE IS SPRINKLED by R. H. Drukker, concrete superintendent, just before dual-drum paver discharges batches.

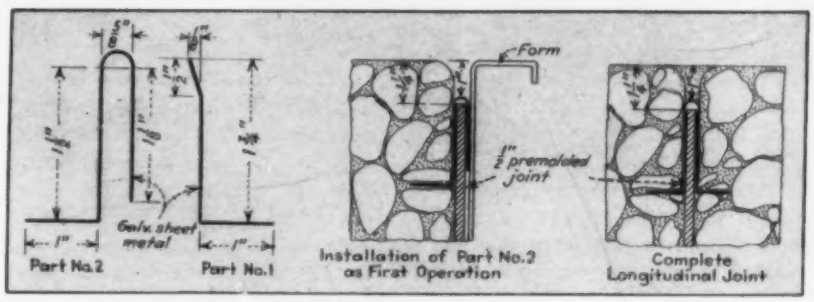
Specifications for Mixing — This year's state specifications for paving concrete in New Jersey, instead of fixing a minimum mixing time, require that each batch "be in motion in the mixing drum for a period of time equal to 35 revolutions of the mixing drum after the recording device has started registering the time of mixing, or as much longer as may be necessary to insure a uniform and homogeneous concrete that has the desired plasticity, workability and consistency."

It is further specified that the drum must be completely emptied before mixing successive batches and that the discharge chute on the mixer must be cleaned before the loading skip is hoisted sufficiently to discharge any materials into the mixing drum. Any concrete that has developed an initial set or has been mixed longer than 30 min. before being deposited in place shall not be used.

On the Union Building & Construction Co.'s contract the speed of the dual-drum mixer is 20 r.p.m. Each batch receives a total of 37 revolutions in the machines, 17 revolutions in the first drum and 20 in the second. The 2 revolutions in excess of the 35 specified as a minimum are allowed for the transfer of a batch from the first to the second drum. At a drum speed of 20 r.p.m. and with 37 actual revolutions each batch remains in the dual drums 1 min. 51 sec.

Concrete Production — Under PWA regulations the contractor operates on a 10-hr.-per-day schedule, using two crews each working 3 days per week in order to comply with the maximum 30-hr. per week restriction on labor. The following figures indicate the rate of production of square yards of concrete pavement 9 in. thick by the dual-drum paver during a normal weekly period:

DUAL-DRUMS of paver are 5½ ft. in diameter and 4 ft. 8 in. long, built end to end and connected by discharge chute inside.



LONGITUDINAL JOINT DESIGN, showing waterproofing features.

Date 1934	*Sq.Yd. of Pavement 9 in. Thick*
June 29	1252
" 30	1314
July 2	1314
" 3	1314
" 5	1314

The concreting crew consists of a total of 20 men, including 1 superintendent, 3 men at the loading skip handling cement, 1 mixer operator, 4 men in the pit shoveling concrete between the forms, 2 vibrator operators, 2 men on screed leveling off concrete 2 in. below the tops of the forms to receive reinforcement and placing the bar reinforcement mats, 1 finishing-machine operator, 4 men on hand belting, brooming, and joint edging, and 2 men setting joints. Curing of the concrete is done under a subcontract, instead of with the contractor's own labor, as explained later.

Gas Electric Finishing Machine — After the concrete has been leveled off roughly by hand shoveling and screeding to a depth of 2 in. below the tops of the forms, the fabricated reinforcement mats are placed and bedded at proper grade by pounding with a screed, operated by two men. A top layer of concrete is then discharged from the mixer bucket to cover the steel reinforcement and finished with a new type

of Blaw-Knox gas-electric finishing machine. This unit is powered by a 23-hp. four-cylinder gasoline engine, which drives an electric generator supplying current to motors for traction through 14-in. roller-bearing reversible drive wheels and also for operating, lifting and lowering both front and rear screeds.

The machine has four speeds forward and four in reverse. These speeds are 7, 14, 33 and 66 ft. per minute. All four wheels are drive wheels. Screeds are of the box type, equipped with shock absorbers. Advantages claimed for the electric drive on this machine are ease of operation through finger-touch control, increased paving production, greater traction for handling dry concrete, increased speed range, cushioned power and smoothness of finish. Connections are available for floodlighting at night and for operating vibrating attachments, when specified. The machine is equipped with four screw-jacks for raising during screed adjustments, wheel changes or in case of derailment from the forms.

On level sections of pavement the finishing machine makes two passes over the concrete, the second one using a belt; on grades, three passes are made. Behind the finishing machine the surface receives final treatment with a long-handled wood float, followed by hand belting and brooming.

Vibration of Concrete—For the first section of this job the New Jersey Highway Department, as an experiment, had substituted for its standard practice of consolidating the newly placed concrete with vibrators of the surface type, two vibrators of the spud type, applied to the area around the special transverse joints previously described, along the line of the longitudinal waterproofing joint caps adjacent to the side forms and approximately every 2 ft. elsewhere in the slab. The change in vibrating method and equipment was tried to overcome certain difficulties encountered with the surface type of vibration at both transverse and longitudinal joints. Later, however, surface type vibrators were substituted for the spud vibrators employed during the test period.

The spud vibrators used on the Butler cutoff contract were Munsell machines operated by air at a pressure of 80 lb. per sq.in. producing a frequency of 3,500 vibrations per minute. Air pressure and volume are controlled through an angle valve and the machine, equipped with pipe handles and operated by one man, weighs 36 lb. The flat, circular head of the spud is 3 in. in diameter. A portable compressor of 110-cu.ft.-per-min. capacity supplies enough air to operate two vibrators of the type in use.

Curing Concrete—On this contract the concrete curing operation instead of being done by the contractor with his own forces, has been let as a subcontract to the Stedfast Rubber Co., of Boston, Mass. The novel feature of the method employed is the use of two layers of different materials to cover the green slab after applying a fine spray of water. Upon the newly concreted 10-ft. strip of concrete is first unrolled, like a rug, a length of thick cocoa matting. This matting is saturated with water by sprinkling with a hose and upon it, as a cover, is unrolled a strip of high quality white rubber sheeting. The heavier cocoa matting is used in rolls having a length of 40 ft., while the lighter rubber sheeting is handled in 100-ft. long rolls. This rubber blanket forms an impervious cover over the saturated cocoa matting and prevents the evaporation of water during the process of curing the concrete. The coverings remain in place from 48 to 72 hr. and are then rolled up, carried ahead on a motor truck and relaid upon a fresh strip of new concrete.

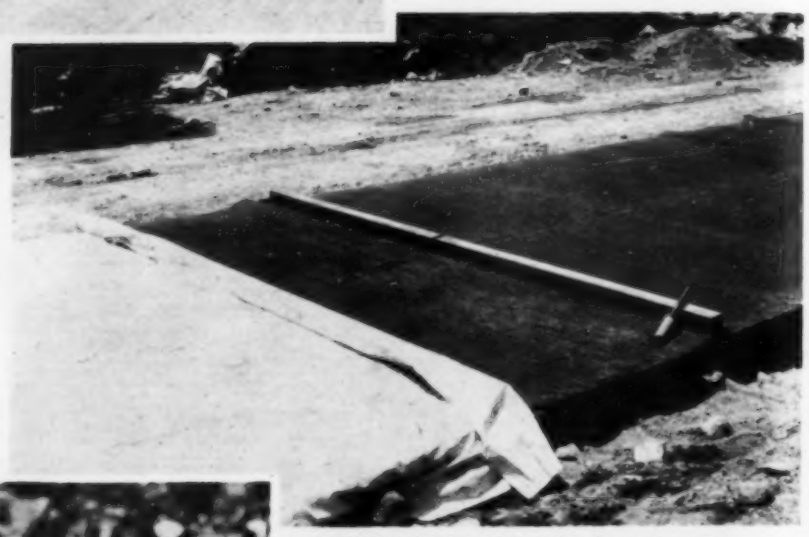
Traffic Stripe—The edges of the 10-ft. wide paved slabs are marked by integral traffic stripes formed by dusting on a film of white cement upon a 6-in. wide band of the newly concreted pavement, using 0.2 lb. of cement per linear foot. Immediately after it has been applied, the white cement stripe is protected by a coating of paraffin wax.

Finished Roadway—In cross-section the finished highway on the Butler cutoff has a total width of 80 ft. Starting at one side there is first, a 10-ft. gravel shoulder, then two concrete-paved traffic lanes each 10 ft. wide, next a 2-ft. gravel shoulder, next the 16-ft. grass covered central "island" or dividing strip and then a repetition of the shoulders and paved surfaces of the other side of the roadway.

Personnel—The Butler cutoff construction is in charge of C. A. Burn, district engineer and C. E. Vanderhoof, resident engineer. For the contractor, the Union Building & Construction Co., of Passaic, N. J., Louis Drukker is vice-president and manager, Robert McCarthy, general superintendent, and R. H. Drukker in charge of concreting operations.

COCOA MATTING *(left)* is unrolled like rug on freshly sprinkled green concrete and saturated with water from hose to cure mix.

RUBBER SHEETING is placed to cover wet cocoa matting and retain moisture during curing period of 48 to 72 hr.

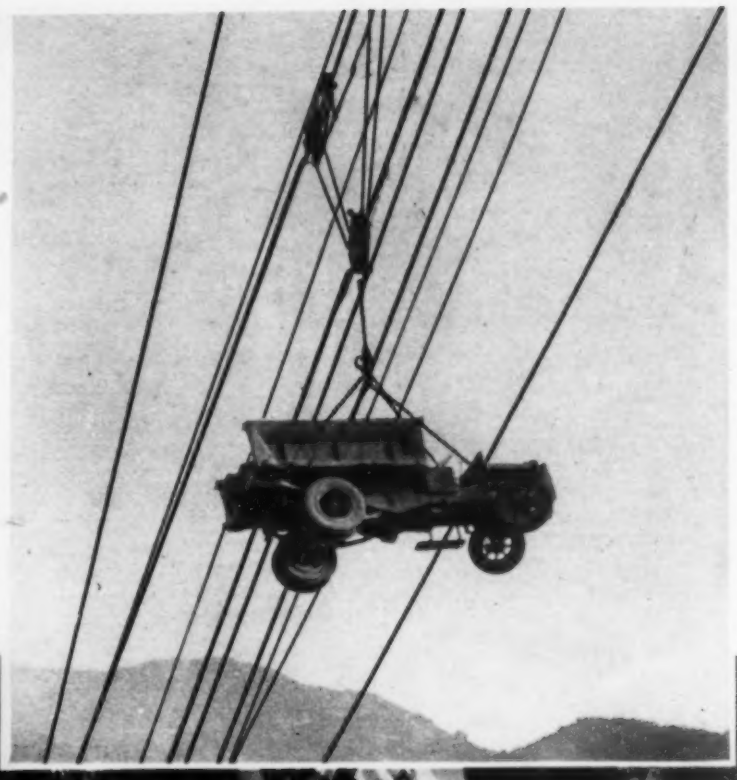


WOODEN STRIP with holes in each end is nailed to end of cocoa matting to facilitate rolling and unrolling.

SPECIAL TOOL facilitates unrolling of cocoa matting.

JOB ODDITIES

A Monthly Page of
Unusual Features of Construction

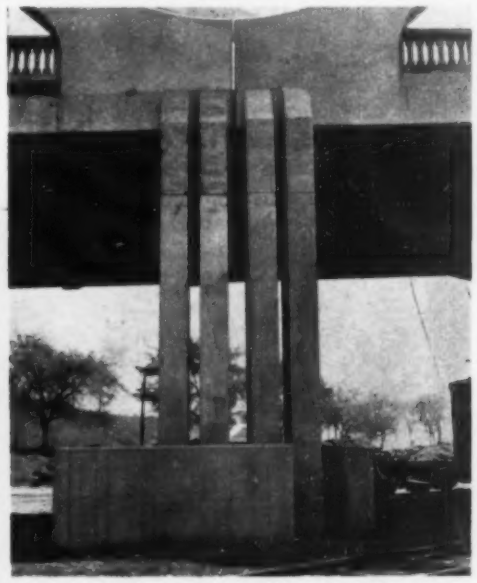


SKY RIDE *(right)* for truck. At Morris (formerly Pine Canyon) dam, Pasadena, Calif., cableway interrupts job of delivering concrete to raise motor vehicle to top of dam abutment.

SPIRE IN SPLINTS. Extensive repairs are being made to St. John's Church, Putney, England, with aid of steel pipe scaffolding. Steeplejack atop 185-ft. spire replaces weather-cock.

TRIBAL HONORS FOR DAM BUILDERS—When bids were opened for Grand Coulee dam and power project on Columbia River in Washington, Frank A. Banks, construction engineer *(left)* R. F. Walter, chief engineer, and Dr. Elwood Mead *(at microphone)* commissioner, of U. S. Bureau of Reclamation were made members of Colville Indian Tribe whose reservation abuts upon one end of big structure.

SWAY BRACING at only possible locations between bowstring arches of skew bridge carrying Second St. across railroad yard makes odd pattern against sky above Richmond, Va., where structure is being built with relief labor by Richmond Bridge Corp. from plans by A. C. Janni, of New York City, design consultant for Allen J. Saville, Inc., engineer for bridge corporation.



TWO PAIRS OF COLUMNS, designed for bending, support ends of skew bowstring arches at center pier of Second St. viaduct, Richmond, Va. Flexible columns allow for expansion and contraction in supported spans.

HUGE CELLULAR COFFERDAM made up of 43 pockets 50 ft. in diameter permits unwatering and excavation of 18-acre area to depth 52 ft. below highest tide for inshore sections of three new 1,100-ft. piers along Hudson River, New York City. Double lines of girders laid flat on cofferdam provide tracks for trucks hauling spoil to dumping platform on river side of cofferdam, where trucks drop loads into barges. In cofferdam pockets at upper left hand corner, unspliced steel sheetpiles 96 ft. long were driven to reach rock bottom.

Cellular Cofferdam

Incloses 18-Acre Area for Building Steamship Piers 1,100 Ft. Long

A CELLULAR COFFERDAM consisting of 43 earth-filled 50-ft. pockets with walls of interlocking steel sheetpiles 46 to 96 ft. long restrained the Hudson River from an area of 18 acres in which slips to El. —46 were excavated for New York City's three new 1,100-ft. piers. The cofferdam formed three sides of an area roughly 300x1,500 ft. in plan and connected at both extremities with existing slip walls. Despite the high cost of a cofferdam of this size, the large expenditure was justified by the great quantity of rock, amounting to more than 500,000 cu.yd., which had to be excavated inside the —46-ft. contour. The dam withstood the removal of rock to El. —46 and extreme high tides to 8.2 ft. above mean low water without serious movement or leakage. Allen N. Spooner & Son, Inc., of New York City, executed the general contract.

STEEL ARC TEMPLET guides setting of steel sheetpiles for curved walls of cofferdam pockets.

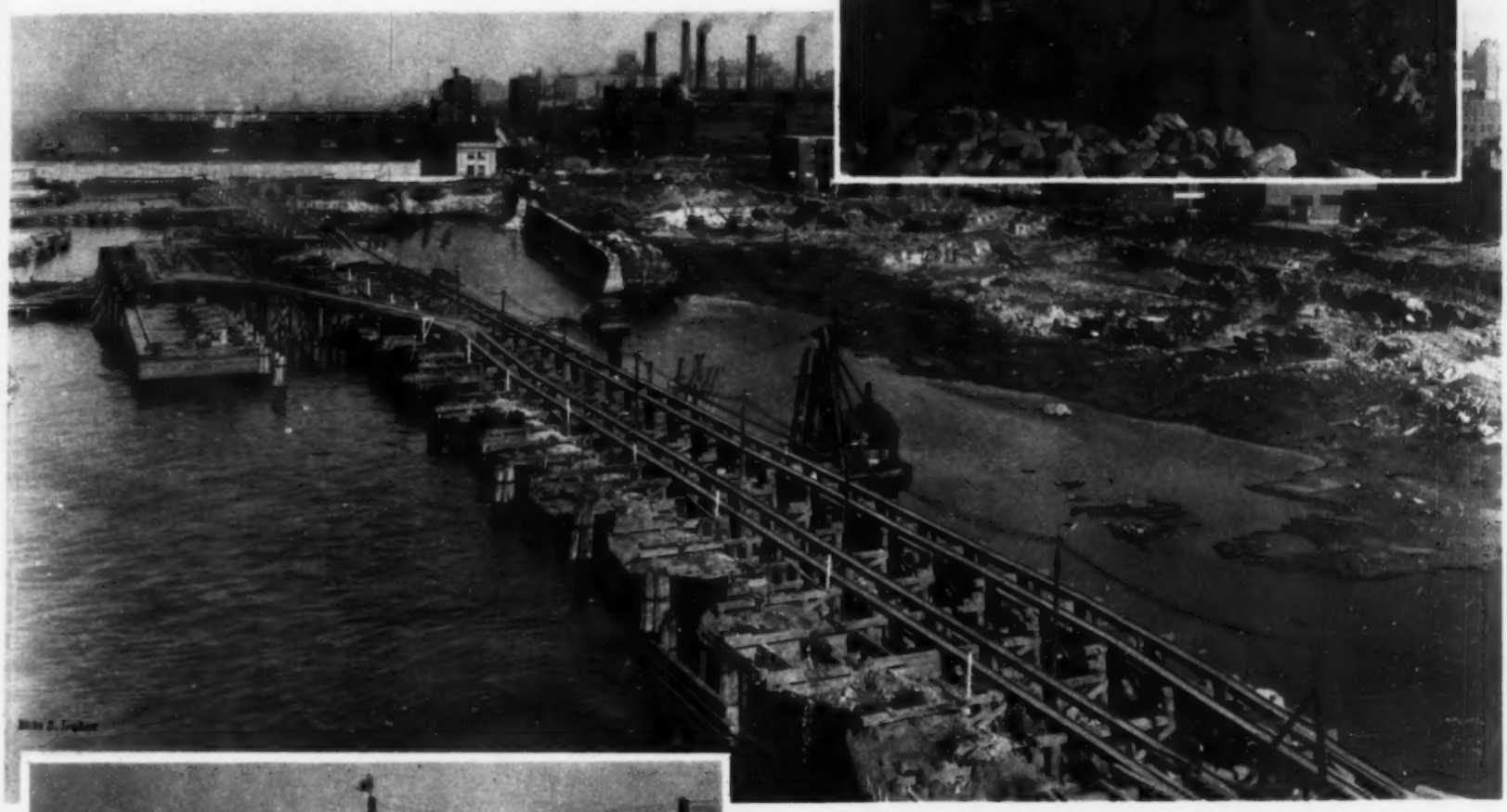
Design of Piers—Ships now under construction by French and British lines exceed 1,000 ft. in length and require longer docks than those of existing 1,000-ft. piers along the Hudson River, New York City. To provide berths for these vessels within convenient distance of the city's hotel and business centers, a site for five 1,100-ft. piers was selected between West 46th and West 56th St. Three of these piers were constructed under the Spooner contract. Permission was granted by the U. S. War Department to extend the pierhead line 75 ft. farther into the river, and the city condemned land to allow the new slip line to be located 25 ft. farther inshore than that of the adjacent 1,000-ft. long Pier 86. The old bulkhead at the site of the new piers was 300 and 325 ft. outside the newly established slip line. Five wood piers 500 and 700 ft. long by 60 ft. wide extended from the

old bulkhead into the river. The city purchased property to permit the new slips to be cut into the shore the required distance.

Preliminary wash borings by the Department of Docks, which had charge of the design and construction of the new piers, established the —46-ft. rock contour at distances of 280 to 420 ft. from the new slip line. Inside the —46-ft. contour (and within the solid-fill portion of the new piers), the side walls and reinforced-concrete column foundations for the pier superstructures rest on solid rock. Rock fill was placed inside the pier walls and around the columns. Beyond a transverse concrete retaining wall on the —46-ft. contour, connecting the pier side walls, the substructure of each pier consists of capped wood piles, supporting a 10-in. reinforced-concrete deck. All pier timbers of every kind above a plane 2½ ft. above mean low water, except piles, side rangers, fender caps and chocks, A-braces, lower horizontal braces and greenheart timbers, are treated with creosote. A rip-rap embankment beyond the transverse retaining wall helps to support the piles nearest the —46-ft. contour, where the depth of river mud and silt covering bedrock is not sufficient for this purpose.

In plan the new piers measure 1,100 ft. long by 125 ft. wide. Slips between the piers are 400 ft. wide. Under this contract, only the wood-pile portion of the piers was covered with a 10-in. reinforced-concrete deck. Two-story pier sheds will be erected later under separate contracts. The new piers, numbered 88, 90, and 92, from south to north, are located at the foot of 48th, 50th and 52nd Streets, respectively.

AT SITE OF EACH SLIP *(right)*, 1½-yd. gasoline shovels load broken rock into 7- and 8-yd. trucks which climb ramps to street level.



THREE GREAT QUARRYING OPERATIONS at locations of slips are carried out inside cofferdam to final grade at El.-46. Sections of old bulkhead wall have to be removed. In foreground is one of four intake sluices in river wall of cofferdam.

DISPOSAL STATION for muck excavated in cofferdam area is erected on wood piles outside cofferdam, where trucks dump through traps into barges.

Conditions at Site—Pier 86, the adjacent 1,000-ft. pier to the south, completed in 1917, had a slip on the north side, of which a portion, 177½ ft. wide, had been excavated to El. —44. This excavation provided a level rock bottom for one end of the proposed cofferdam. Of the five existing wood piers, three were removed entirely, and portions of two, between the new piers and outside the cofferdam, were left standing to provide ready-made platforms for unloading materials and loading spoil. A 600-ft. section of the bulkhead at the shore end of these piers, constructed under water with the aid of divers about 40 years ago, consisted of precast concrete blocks weighing up to 90 tons each resting on a foundation of concrete in bags placed on bedrock by the divers. The concrete in this bulkhead wall was in first-class condition and required persistent work with drills and other pneumatic tools to break up and remove it.

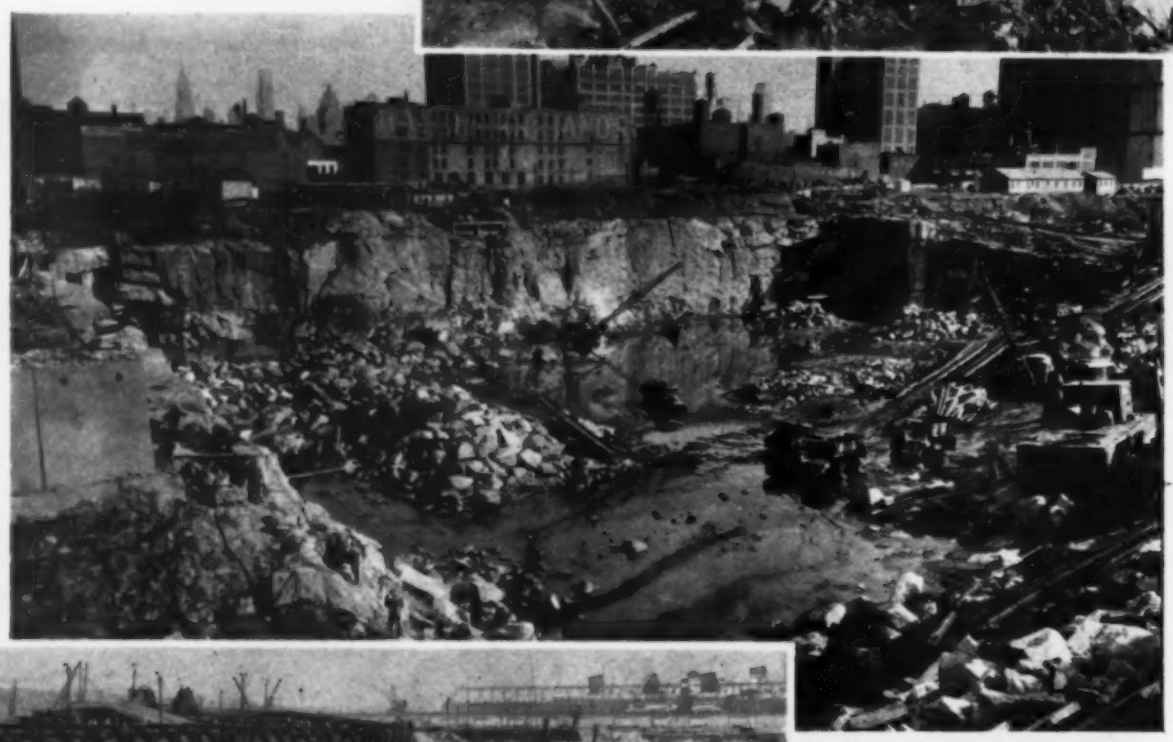
Distance from the new bulkhead line to the —46-ft. contour decreases from north to south, and the lengths of the solid-fill portions of the piers constructed on rock diminish in proportion from 445 ft. at Pier 92 to 385 ft. at Pier 90 and 305 ft. at Pier 88. The cofferdam

was located to provide a minimum space of 75 ft. betwen the —46-ft. contour and the inshore wall of steel sheetpiling. Beyond the —46-ft. contour, the inclination of the rock surface varied from a steep slope at the north end of the cofferdam to a more gradual pitch at the south end. Sheetpiles in the outshore wall at the north end of the cofferdam were driven to rock at El. —86, requiring pile lengths of 96 ft. Rock under the outside wall at the south corner of the cofferdam was reached at El. —65, and the length of the piles was reduced correspondingly to about 75 ft.

Design of Cofferdam—In the original construction plan which was furnished prospective bidders, the Department of Docks proposed a cofferdam consisting of: (a) an earth-filled cellular sheetpile core (of rectangular pockets, each 16x24 ft.) to form a water seal; (b) an embankment of riprap on the inshore side to hold the cellular core against the external pressure; and (c) an embankment of earth on the outshore side to hold the cellular core in equilibrium against the pressure of the riprap embankment during construction. The department, however, offered to study and accept, if satisfactory, any alternative cofferdam plan.

An alternative plan utilizing a cellular gravity-type cofferdam, designed by H. A. Sloane, Inc., consulting engineers, of New York City, was submitted by the successful bidder and was approved after modification by the engineers of the Department of Docks.

40-YEAR-OLD BULKHEAD WALL *(right)*, made up of 90-ton precast concrete blocks resting on bag concrete foundation placed by divers is demolished where necessary to permit slip excavation. Portions of wall are left standing on pier locations.



EXCAVATION FOR ONE SLIP involves removal of hard rock for width of 400 ft. to depth of more than 50 ft. below grade of Twelfth Ave., in background. Sides of slip are sheer vertical walls of rock.

EMBANKMENT OF GRADED RIPRAP placed by dumping through chutes from inner girder track is built against inside of cofferdam as precaution to resist movement. Timber ramps carry trucks to high ground.

The modification, consisting of a larger amount of graded rockfill embankment against the back of the cofferdam, was acceptable to the contractor, and the cofferdam was built with this addition.

As designed and constructed, the cofferdam had 36 typical cells, measuring 50 ft. between diaphragms, and seven cells of special dimensions at the corners of the coffer and adjacent to the end connections with existing bulkhead walls. All diaphragms of the cofferdam, consisting of 39 straight-web piles and two Y piles, were 50 ft. 1 in. long between centers of Y's. Each typical pocket had inside and outside walls made up of 41 straight-web piles driven on arcs of 46-ft. radius and interlocked at each end with the Y piles. The maximum dimension between the two arcs was about 63 ft.

Preliminary Operations—As the first step of the construction program in the cofferdam area, dipper dredges excavated silt and river mud to El. —30 over the entire area and cut a trench along the toe of the proposed rockfill embankment. The revised cofferdam plan required the excavation and filling of this trench with rock to retain the embankment and to prevent the rockfill, when it would be deposited later, from pushing inshoreward into the soft river bottom. While this work was going on, the contractor drove test piles along the line of the proposed cellular cofferdam to determine accurately the length of steel sheetpiling which would be required to penetrate to bedrock.

Cofferdam Construction—Construction of the cofferdam was started at the south end adjacent to Pier 86, where rock conditions were known and where the contractor would have an opportunity to determine the most desirable procedure to follow in driving steel sheetpiles and filling the cofferdam pockets. A second crew soon began operations at the north end, and the two outfits worked toward each other until they had completed all the cofferdam except a gap of two cells left in the river wall for floating equipment. Each outfit carried on the piledriving with a crawler crane which advanced on 24-in. I-beam stringers laid across the top of timber pile bents driven inside the pockets. Three wood-pile bents were installed in advance inside the perimeter of each cell by floating piledrivers which drove 60- to 90-ft. piles in three rows of about nine piles each and capped them with 12x12-in. timbers. Deck pads made up of heavy timbers were picked up by the crane and laid ahead on the stringers as the machine advanced.

A steel arc templet to guide the sheetpiles was placed on the timber bents, and two floating derricks, one with 120-ft. boom and the other with 140-ft. boom, set the sheetpiles against this templet. Pile-driving was carried on progressively around each cell, the piledriver making as many rounds with the hammer as required by driving conditions. At the south end of the

A. J. DUGGAN, resident engineer, stands beside one of giant reflectors used for night work.

6,800-LB. STEAM HAMMER handled by oil-burning steam crawler crane traveling on deck pads on steel girders drives steel sheetpiles up to 96 ft. long in cofferdam pockets. Caps of pile bents carry girders.

cofferdam, where construction began, one round was sufficient for penetration through uniform cover to rock. As the length of piles increased, however, it became necessary to drive the piling by stages, and the hammer was moved around the walls of a pocket as many times as necessary.

Two oil-burning Bucyrus-Erie steam cranes drove all the sheetplies with 6,800-lb. McKiernan-Terry steam hammers hung on 50-ft. booms. Each unit drove 180 steel sheetpiles (about 1½ pockets) per day, which were as many piles as the two floating derricks could set. Each pocket required 121 sheetpiles, 39 in the diaphragm and 41 in each arc.

Piles were ordered from the mill in exact lengths to fit the foundation conditions determined by test piles. Each pile bore a mark, stamped on at the mill, which indicated its exact position in the cofferdam, and the piles were delivered to the job in the order in which they were to be driven. The piling was Bethlehem straight-web section S. P. 15 weighing 38.4 lb. per linear foot of pile and 30.7 lb. per square foot of wall. The piles ranged in length from 46 to 96 ft., the latter being the longest unspliced length of steel sheetpile ever driven. Almost 7,500 tons of sheetpiling was required for the cofferdam.

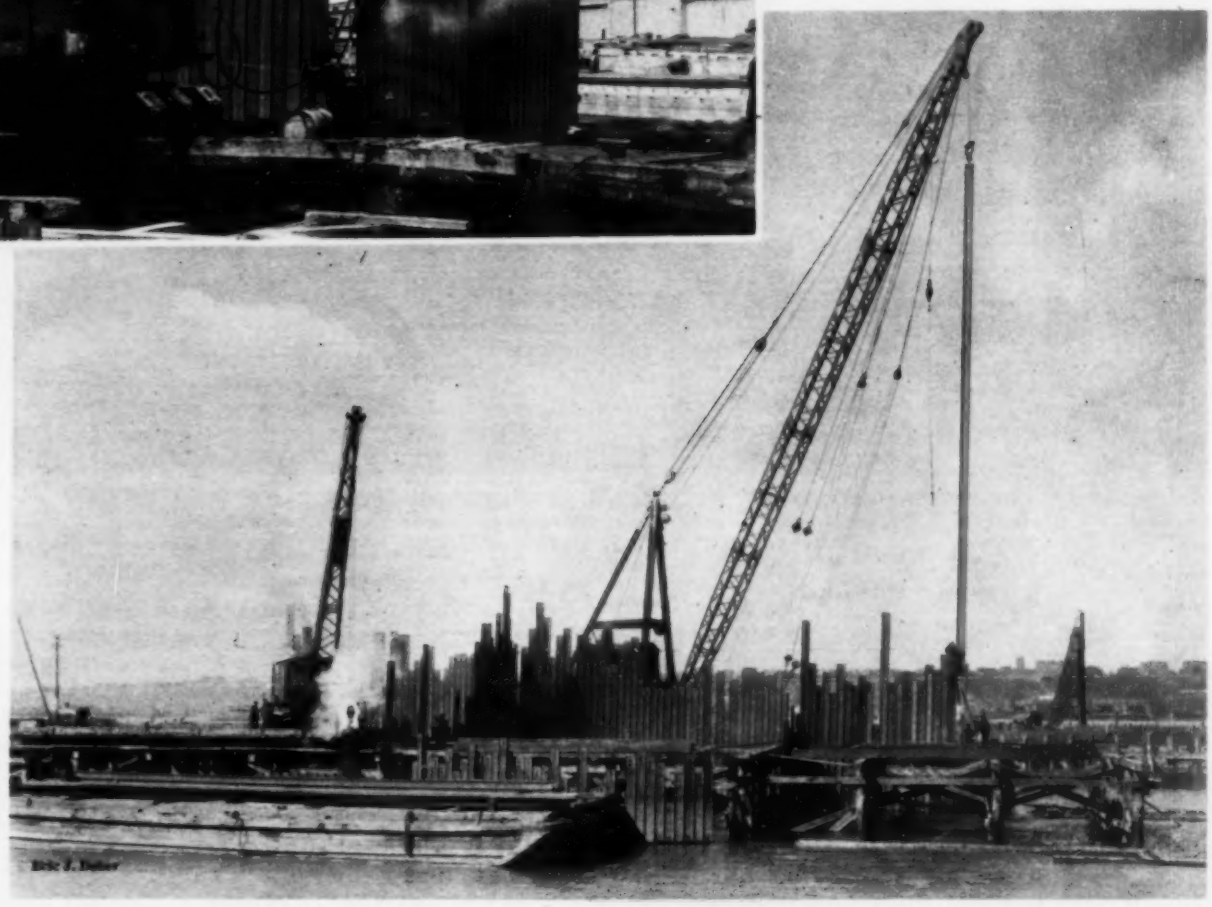
Driving on the whole was more uniform than might have been expected. In only one place was it necessary to drive a tapered pile. At two points where piles struck boulders or other obstacles and refused to drive to rock, the contractor jetted inside these piles and placed clay fill on the inside and broken rock on the outside, effectively sealing the bottom of the pile and stopping all leaks. In general, the piles drove to practically uniform elevation, demonstrating that the depths to bedrock determined by test piles had been accurate.

Specifications required earth fill aggregating 180,000 yd. for the cofferdam pockets. Some earth was obtained from stripping inside the old bulkhead walls at the site of the piers, but most of the fill material consisted of clayey sand hauled from real estate developments on Long Island. Filling of the cofferdam cells proceeded by progressive stages, material being placed simultaneously at varying depths in several pockets. A close check was kept by inspectors on the placing of fill, and loads were dumped in different parts of each cell to keep the top of the fill at about the same level within the pocket.

As each piledriving crane moved ahead on the cofferdam, the steel I-beam stringers were turned in flat position on the timber bents to form tracks for the dump trucks. On the upstream and downstream arms of the cofferdam, five lines of girders were used for this purpose. Two lines were laid to form a track on the river side of each arm, and the other three were placed on the shore side to provide two tracks, with the middle girder serving as a rail for both tracks. One of these two tracks was used by the trucks hauling earth fill for the cofferdam pockets; the outer track, resting partly on projecting ends of the 12x12-in. caps, carried trucks dumping riprap into the rock embankment.

Along the river wall of the cofferdam only four lines of steel girders were used, the inner track being elevated to permit trucks to dump riprap through steel-lined wood chutes inclined at the proper angle to deposit the rock to the desired slope. Rock for the first stage of embankment construction was delivered in scows and the embankment was built up to final dimensions as progressive unwatering of the area within the cofferdam exposed and made available additional quantities of rock. In pumping out the cofferdam, the water level was lowered to successive predetermined stages as the dump trucks built up the embankment of graded riprap.

Seals at the two ends of the cofferdam, where the structure connected with existing slip walls, were formed by driving one inner and two outer lines of splined timber sheeting and filling with a selected grade of clay. A clay-fill embankment, held in place with a close row of piles backed up with riprap, was placed outside each seal. The width of each seal, i. e., the distance between the concrete slip wall and the first diaphragm of the cellular cofferdam, was 7½ ft. at the north end and 5 ft. at the south end, and the depth to the mud bottom of the river was 20 ft. or less. No leakage passed through the seal at the south end of the cofferdam, and only a small amount of seepage was admitted at the north



FLOATING DERRICK sets long sheetpiles for arc section of cofferdam pocket against steel templet on pile bents in advance of piledriving crane.

end. Cutoff walls of steel sheetpiling were driven inland from the north and south slip walls about 250 ft. and 100 ft., respectively.

Four intake sluices were provided in the river wall of the cofferdam. These sluices were made as large as permissible without affecting adversely the stability of the cofferdam at extreme high tide. They were about 20 ft. wide and were equipped with manually-operated gates; at mean low tide the head at the gates was about 1 ft.

After excavation and concreting had been completed inside the cofferdam, the inclosed area was flooded, and the long sheetpiles in the cofferdam were pulled by a floating rig of 300-ton pulling capacity equipped with a fifteen-part hoisting line leading to an American Hoist & Derrick Co. steam hoist engine. A Vulcan pile extractor attached to the pulling tackle was used to loosen some of the longer piles.

TRUCKLOADS OF SPOIL and of acceptable fill material for cofferdam cells travel over girder tracks laid on pile bents. Note chutes for placing riprap embankment by dumping from girder track. Ship at left is tied up to outshore end of Pier 86, 1,000 ft. long, completed in 1917.

WHILE WORK ON COFFERDAM PROCEEDS, construction of timber-pile outshore sections of three 1,100-ft. piers advances rapidly. Portions of two old piers are left standing to serve as material-handling and storage platforms. Part of Pier 86 appears at right.

THREE WAGON DRILLS perform line-drilling operation for vertical rock faces of slip walls.

Rock Excavation—Excavation within the cofferdam was subcontracted to Clarence L. Smith, Inc., of New York City. The original estimate of 487,000 yd. of rock excavation was exceeded by several per cent because of the necessity of removing seams of unsound rock in a formation consisting principally of Manhattan schist, with some pegmatite. Depending upon the proportion of mica, the Manhattan schist varied from a hard rock to soft. In general, the schist was sound, but in some places appreciable quantities of this rock had to be excavated beyond the proposed lines and grade of the slip and pier walls. The pegmatite was a species of granite and was a hard, sound rock.

At the beginning, rock excavation was delayed by demolition of existing buildings and then was retarded by the necessity of taking out 150,000 yd. to provide riprap for the rockfill embankment before the cofferdam could be completely unwatered. The embankment itself required only 100,000 yd., but an excess of material had to be excavated to furnish fill of the proper gradation. It was necessary to leave a dike of natural soil on the river side of the area from which the subcontractor removed this rock.

Following these initial activities, rock excavation was carried on in three quarrying operations, one in each slip area, separated by the projecting shoulders of rock at the pier locations. In general, drilling and blasting were performed by the benching method, with each crew working against a rock face 10 to 15 ft high. Drillers on top of the benches sank vertical holes in rows parallel with the face. The holes were loaded with 40 per cent gelatin dynamite and were blasted whenever additional rock was required by the shovels. Woven wire-rope mats were used to cover each blast. Excavating operations went forward 24 hr. a day for 5 days each week. During a period of about 4 months when this work was at its height, the contractor burned about 3,000 lb. of dynamite every 24 hr.

Bench drilling was performed with Ingersoll-Rand jackhamers, supplemented by one truck-mounted wagon drill. Of the 36 jackhamer drills which the contractor kept on the job, an average of 25 was in constant use.

At the sides of the piers and at the ends of the slips, the plans called for sheer vertical rock faces to El.-46 upon which concrete walls were to be constructed. To cut these vertical faces, the excavating contractor employed three Ingersoll-Rand wagon drills mounted on skids. These machines performed a line-drilling operation, sinking vertical holes on 12-in. centers to grade and interspersing these bores with holes 15 ft. deep at 6-in. intervals. Each machine carried an Ingersoll-Rand drifter drill to sink the holes, which were started with a 4-in. bit. An air hoist on each rig raised and lowered the drill and handled the drill steel.

Before beginning the line drilling, fractured rock at the surface was removed to form a shelf for the drill rigs, leaving a maximum depth of about 50 ft. to grade. Along the sides of the piers, this depth decreased to zero as the machines approached the 46-ft. contour. In all, the wagon rigs line-drilled about 3,000 lin.ft. of rock face, sinking an estimated total length of more than 10 mi. of vertical holes. Upon blasting, the vertical faces broke clean in most instances. At several places, rotten rock caused jagged breaks extending back of the vertical plane. It was necessary in these places to remove all the unsound rock and occasionally some of the overhanging solid rock by subsequent drilling and blasting.

A roofed-over open-air blacksmith shop equipped with two Ingersoll-Rand

sharpeners, three oil furnaces and a shank grinder reconditioned the steel for all the drills on the job. The grinder trued the ends of the shanks to reduce breakage caused by bent steel.

A central compressor station consisting of one large stationary unit and a number of portable units was installed about midway of the project on the high side of the excavation. These compressors delivered air to a 6-in. main, extending along the top of the excavation, from which smaller lines were taken off as needed. The principal unit of the battery was an Ingersoll-Rand two-stage vertical compressor having a displacement of about 1,360 cu.ft. per minute. This machine was driven by a Waukesha 215-hp., six-cylinder gasoline engine and was mounted on a structural steel base which made the entire unit semi-portable. In addition to the large compressor, the plant included a dozen Ingersoll-Rand portable compressors with a piston displacement of 325 cu.ft. per minute each, and a new-type Ingersoll-Rand portable air-cooled two-stage unit with a capacity of 370 cu.ft. The entire plant had a piston displacement of about 5,500 cu.ft. per minute.

Before closing the cofferdam, it was necessary to complete diversion of several street sewers which formerly discharged into this area. Clarence L. Smith, Inc., cut the trench for the diversion sewer, much of which lies in rock, and constructed the temporary intercepting main.

Disposal of Spoil—Broken rock was loaded into Mack 7- and 8-yd. trucks by seven Thew Lorain 1½-yd. gasoline crawler shovels. The trucks traveled up ramps to the street level and over the steel girder tracks on the cofferdam to disposal stations on the river side. Large pieces of rock, suitable for breakwater construction, were hauled from the cofferdam over a connecting pile trestle to a section of one of the old piers left standing outside the cofferdam. Here, the large rock pieces were unloaded by derrick on to the deck of the pier or were transferred directly from the trucks to barges.

Finer material was hauled on the steel girder tracks to a special dumping station erected on timber pile bents alongside the river wall of the cofferdam. The trucks dumped their loads directly into bottom-dump scows under the timber bents. This spoil was disposed of by dumping at sea.

In addition to the shovels, the contractor operated two Thew Lorain crawler cranes, one of 15-ton capacity and one of 8-ton, and two Northwest crawler cranes. These machines handled the blasting mats and performed other services.

Construction of Piers—Simultaneously with the cofferdam operations, the contractor carried on the construction of those portions of the three new piers which are well outside the cofferdam area. Floating plant was employed to drive timber piles and place the concrete decks.

Progress—Construction was carried on continuously by three shifts a day, 5 days a week. Operations began Nov. 16, 1931, and the work was completed and accepted July 31, 1934.

Supervision—Under John McKenzie, commissioner, and F. T. O'Keefe, chief engineer, the work was directed for the Department of Docks of the City of New York by A. J. Duggan, resident engineer. For Allen N. Spooner & Son, Inc., F. R. W. Cleverdon, and Ray N. Spooner supervised operations, and W. A. Morton was general superintendent on the project. Horace G. Smith was general superintendent for Clarence L. Smith, Inc., on the excavation. The dredging was done by the Great Lakes Dredge & Dock Co.

BENCHING OPERATIONS are carried forward by jackhammer drilling and blasting. Wire-rope mats cover each blast.

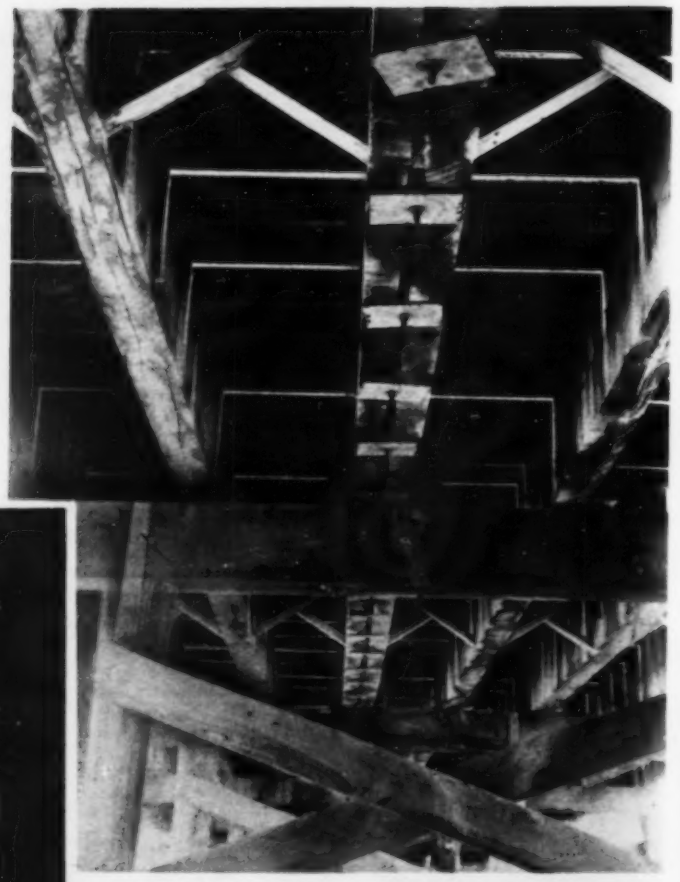
TRUCK-MOUNTED WAGON DRILL supplements jackhammers in benching work.

FLOATING EQUIPMENT FOR PULLING PILES has fifteen parts of steel hoist line reeved through seven-sheave block at top of 70-ft. tower. Horizontal locomotive boiler furnishes steam to two double-drum deck engines and to 9x10-in. double-cylinder, single friction drum, high purchase, back geared hoist engine designed for single-line pull of 40,000 lb. at 55 ft. per minute. Total pulling capacity of equipment (300 tons) is adequate for extracting all cofferdam piling.

Getting Down to

DETAILS

[Close-up Shots of Job Methods and Equipment]

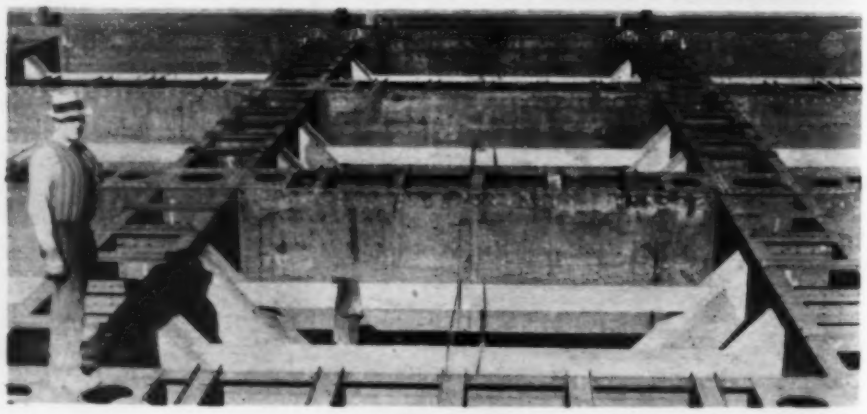


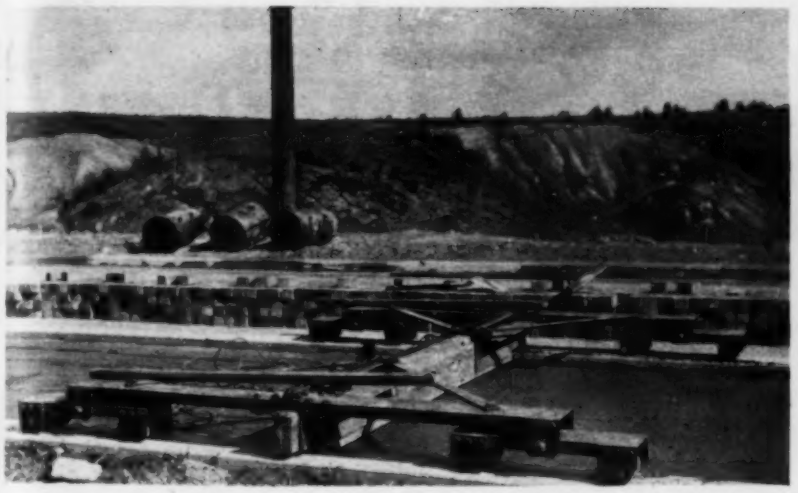
DEMOUNTABLE BRIDGE (*below and at right*). Ohio State highway department has designed standard temporary timber structure with bolted connections, using practically no spikes or nails. The bridge can be taken down and re-erected at another site with almost 100 per cent salvage.

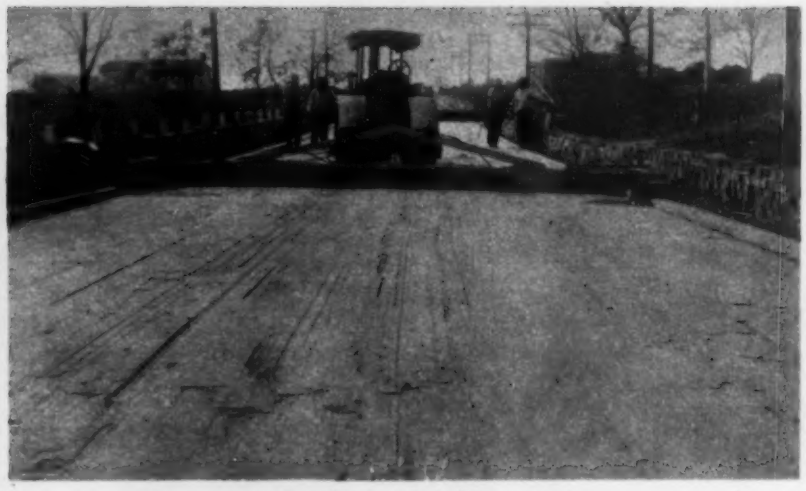
UNDERSIDE of demountable bridge, designed by Ohio state highway department, showing stringers and method of holding floor planks to permit removal and re-use at another site.

CONCRETE PILE CASTING (*below and in insert*) for six channel bridges on line of new 5-mi. causeway leading from Freeport to Jones Beach State Park on south shore of Long Island, N. Y., is done by hopper-bottom bucket running on overhead rail track carried by traveling gantry. Concrete materials are delivered by barge and mixed by Raymond Concrete Pile Co. in plant equipped with tower and chute for distribution to gantry bucket (*in insert*). Project required 1,726 concrete piles, the largest 24 in. square and 95 ft. long. The mix was 1:1½:3 and steel reinforcement up to 1¼ in. square was employed.

SAFETY VESTS (*right*), in the form of life preservers, must be worn by workmen of Bridge Builders, Inc. to reduce danger of drowning in rough waters of San Francisco Bay, where contractor is building channel piers of San Francisco-Oakland Bay bridge. In cool climate of bay wearing of vests does not seriously discommode workmen.



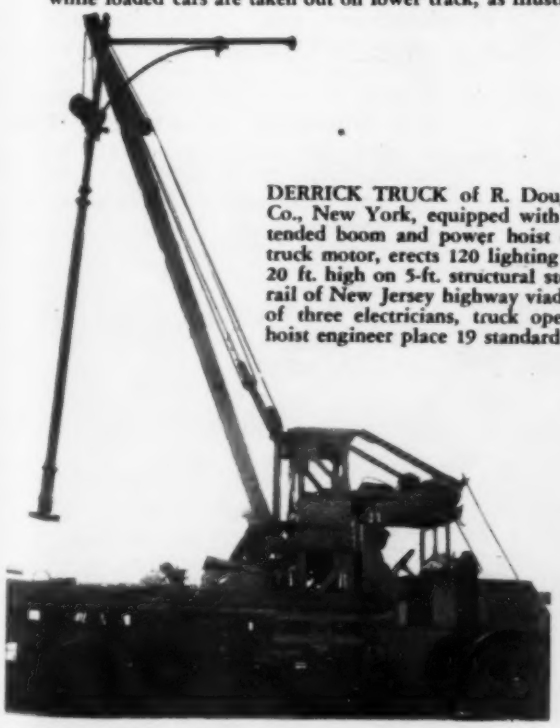




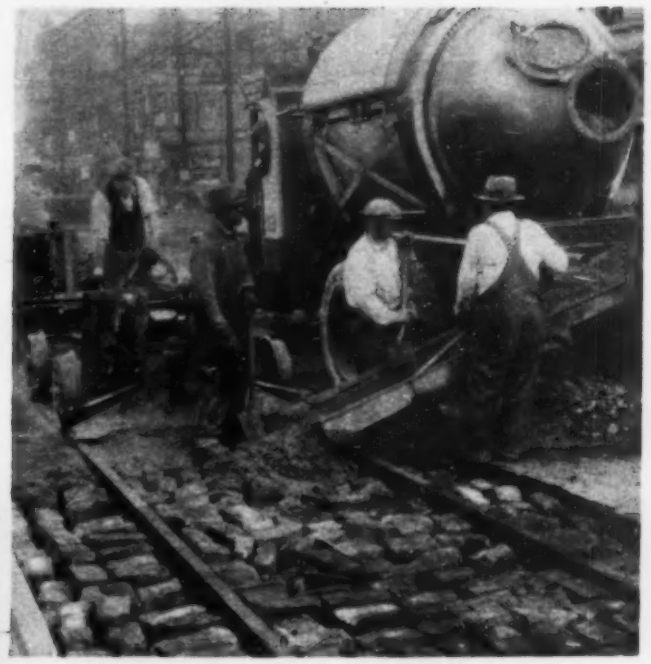
TEMPLATES FOR CUSHION COURSE of brick pavement. To insure correct surface contour of sand or mastic bed latest specifications require substantial construction of templates with overhead framing and compensating carriages on rollers for curb support, and disks if one end travels on concrete base course. Yoke and compensating carriages are shown in view at left, while stiffening truss prevents sagging of template in view at right.

GRASSHOPPER, used by Metropolitan Water District of Southern California, in tunnels of Colorado River aqueduct, is combined drill carriage, car-passer and timbering jumbo designed by H. J. King, superintendent, Hamilton & Gleason Co. View shows rear end of 150 ft. steel frame with hinged ramp at either end. Empty cars (one is shown on upper level track) are switched over upper track and down to mucker, while loaded cars are taken out on lower track, as illustrated.

RECLAIMING OLD LAKE at summer resort in Buchanan county, Mo., is done by Consolidated Paving Co., of St. Joseph, with aid of Adams elevating grader which cuts two channels 8½ ft. deep around island being formed at center of lake. Machine, with wide tires on wheels to traverse soft ground, cast and re-cast inward to build island and cast and re-cast outward to form 1½ mi. shore line with 1 on 3 slope. Grader averages 4,500 yd. of earth moved per 10-hr. day.



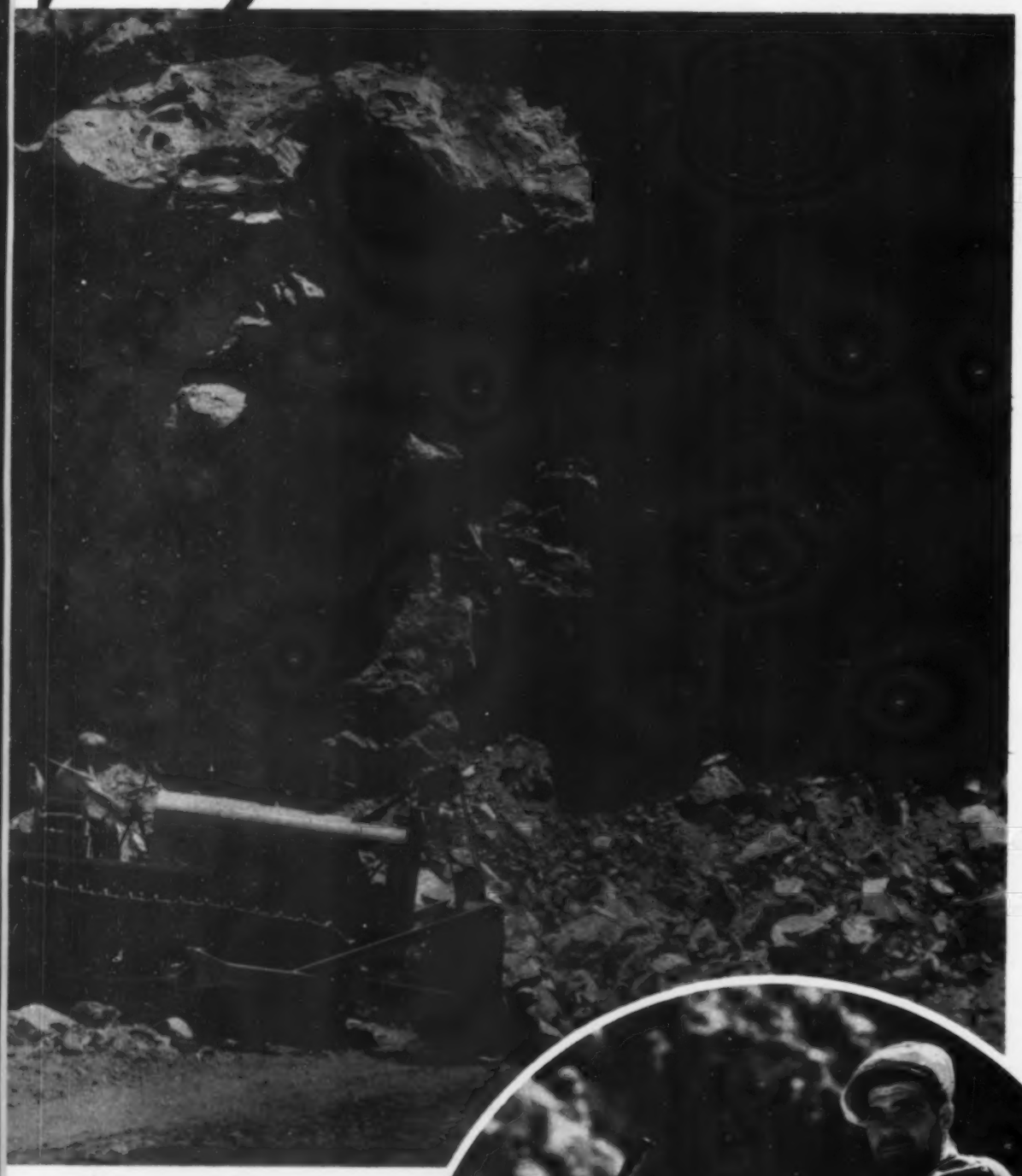
DERRICK TRUCK of R. Doughty Sons Co., New York, equipped with 35-ft. extended boom and power hoist driven by truck motor, erects 120 lighting standards 20 ft. high on 5-ft. structural steel guard-rail of New Jersey highway viaduct. Crew of three electricians, truck operator and hoist engineer place 19 standards per day.



OLD PAVING BLOCKS are placed between and alongside rails of Cleveland Railway and embedded in 1:2:3 concrete vibrated into place and finished with a screed. Economy measure reduces required amount of concrete and lowers cost of paving between tracks.

...in July they bought ther

West Slope Construction Company



who are building San Gabriel Dam No. 1 near Los Angeles, purchased four "L's", one "K" and two A-C motor graders in 1933. In March, 1934 they bought another "L"—in June another—and in July, their eighth A-C tractor. This continued preference for A-C equipment indicates what they think of A-C performance.

The West Slope Construction Company is made up of such nationally known firms as Foley Brothers, Inc., Bates & Rogers Construction Company, Inc., J. C. McGuire, and The Lawler Corporation.

Described as the world's largest rock-filled structure, San Gabriel Dam No. 1, is an $11,890,000 project . . . will be 1,650 feet long on the crest . . . rising 360 feet above bedrock . . . 900 feet thick at the base . . . 30 feet thick at the crest. Reservoir capacity, 62,000 acre feet . . . Reservoir area, 500 acres. West Slope contracted to complete the job by June, 1938. Work was begun in March, 1933, and they moved 4,500,000 cubic yards of rock in 17 months.

West Slope wanted dependable equipment for this huge project . . . that is why they have consistently purchased A-C tractors and road building machinery. Dependability for your job is most important, too. It will pay you to do what other contractors are doing all over the country . . . investigate the "More Value" features of A-C equipment and buy dependable performance. There is a unit for every job—track-type and wheel type tractors, power controlled graders, hand controlled graders, elevating graders, Speed Patrol graders, power units, track wagons and wagon tracks.

ALLIS-CHALMERS
TRACTOR DIVISION—MILWAUKEE, U. S. A.

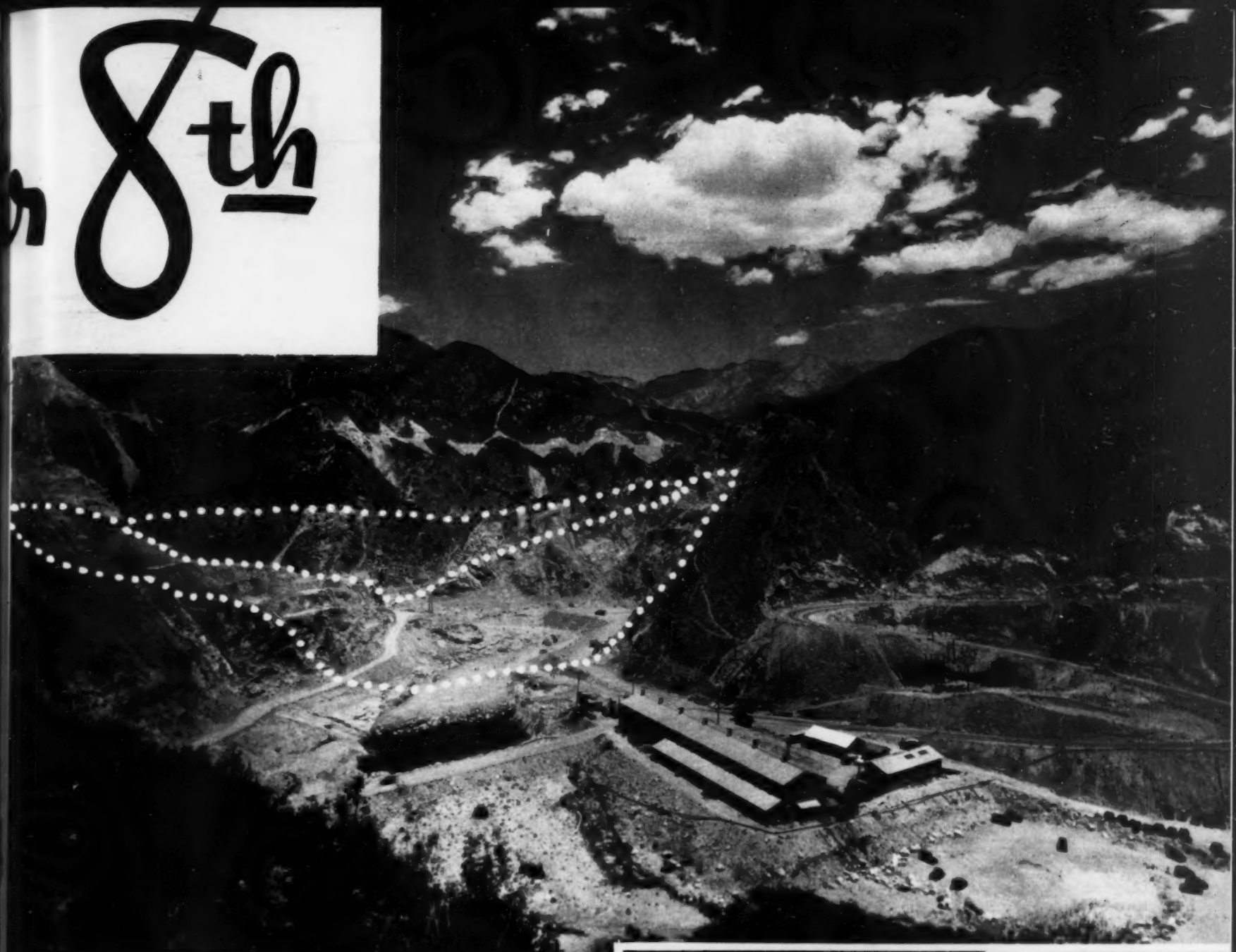
Rocks, Rocks, Rocks

And more rocks. Western contractors have found that the "L's" surely take it. It takes power to push rocks and strength to stand their punishment. That's what the "L's" have and plenty of it.

"You Bet I Like The 'L',"

Said operator C. R. Capps. "I wish you could watch this baby every day. Down here we have to push over rocks that weigh around 10 tons, and this 'L' pushes 'em. Easy to handle and plenty of power. Repairs? She is never laid up."

8th



The Site of The Dam

The dotted line indicates the height and breadth of this huge project. The road leading in from the right comes from the rock quarry . . . and is one of the project's roads kept in A-1 shape by two A-C motor graders.

A-C Pioneered two reverse speeds and six speeds forward for two reasons . . . faster backing up on bull-dozing work, and higher forward speeds on hauling jobs. If you are still using three speed tractors on your job you are losing yardage every day.

Material-Handling Plant *for* NORRIS DAM

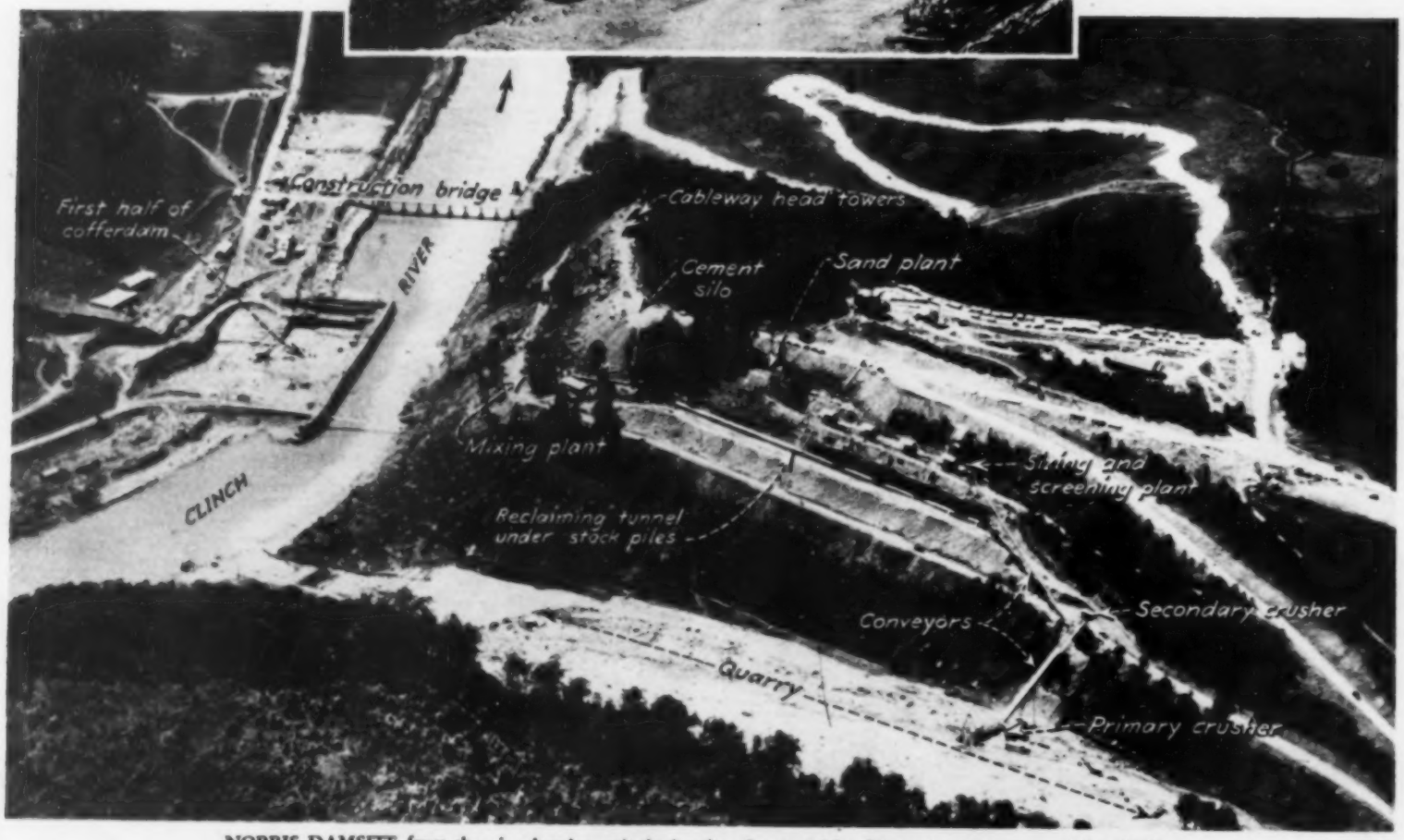
PLANS for the construction of Norris Dam of the Tennessee Valley Authority project contemplate using sand and crushed rock, produced from a deposit of dolomitic limestone immediately adjacent to the site, for nearly 1,000,000 cu. yd. of concrete required for the main structure across the Clinch River, the power house and auxiliary works. Quarrying, crushing, screening, conveying and delivery to a central concrete mixing plant of the stone and sand are all laid out on a straight-line production basis. Output of the mixing plant is transferred by rail to within range of two cableways spanning the site of the dam. Practically the entire plant is of steel construction erected throughout with rivet bolts at important connections to permit easy dismantling and reuse on future projects of the TVA program.

In the selection of the plant and equipment that has been installed provision was made for such flexibility of operations as reasonably varying conditions might require. Storage at various points in the line of production also will permit various units to continue running for a time in case it is desired to shut down sections of the layout ahead of or behind them. On the whole, however, the general scheme is based on operation of all units six days a week on a 22-hr.-a-day basis.

Electric Motor Drive—With the exception of air drills in the quarry, all the plant and equipment for the quarry, the crushed stone and sand plant, the concrete mixing plant and the cableways are driven by electric motors. Air also is supplied from a motor-driven compressor plant. Throughout the layout full advantage has been taken of the possibilities of motor drive and of close control of operations over a distance of nearly ½ mi. from the quarry to the adjacent end of the dam, which in itself is to have a crest length of about 1,800 ft.

The Quarry—Located on the face of a steep sidehill with a thin overburden of clay, the somewhat stratified deposit of dolomite at the site of the quarry is comparatively easy to drill for blasting. Drilling is done with a group of eight wagon units using drill steel in 30-ft. lengths. These same units were first employed in dilling for the excavation

SECONDARY CRUSHER TOWER being erected, with conveyors from primary crusher (at left) and from secondary crusher (at right) leading to sizing and screening plant.



NORRIS DAMSITE from the air, showing principal units of material-handling plant in process of installation between quarry and cofferdam in Clinch River.

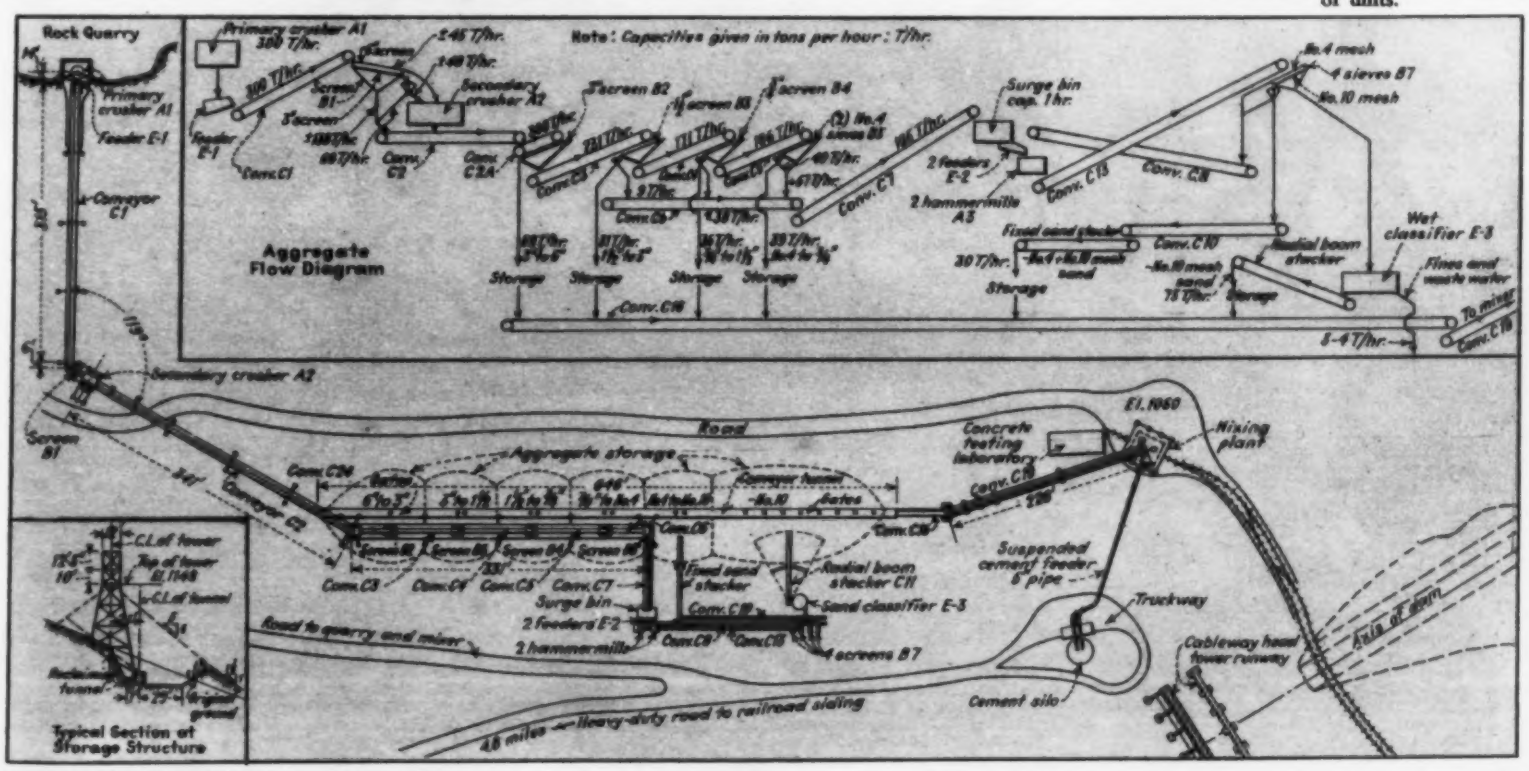
MATERIAL-HANDLING PLANT under construction, as seen from the mixing plant.

necessary to prepare the foundation of the dam. They have been found specially suited for the type of rock encountered. Much less difficulty is experienced in shifting them on the face of the quarry than would be the case with well drills. The wagon drills also permit much faster and more economical drilling than is possible under the local conditions with smaller types of somewhat greater portability. For secondary drilling, however, some hand-hammer drills are used.

As soon as the face of the quarry has been developed to its total length of 1,200 ft. to permit a regular sequence of operations, it is planned to work in 28-ft. lifts. Spacing of holes and methods of loading with 40-per cent dynamite were still being experimented with at the time these notes were prepared. Plans are to drill and shoot a 250- to 300-ft. length of face at a time to reduce to a minimum interruptions of drilling and mucking.

Spoil from the blasting is loaded into 10-yd. dump trucks by two 3-yd. motor-driven power shovels. These trucks and shovels were used previously in handling the 375,000 yd. of earth and rock that were removed in preparing the foundation of the site of the main dam. Remarkably smooth, economical service was obtained from both shovels. No difficulties were experienced in handling the 2,300-volt cables which deliver energy to the shovel motors from adjacent transformers. In the quarry the conditions are about the same, with frequent blasting and with men moving around the shovels constantly. Shifting of the cables also is simple, requiring no special provisions and involving only routine work by common labor.

The haul from the shovels to the primary crusher at the quarry will not exceed 1,500 ft. and will average much less than that distance. Even with this short haul the decision was made to use a fleet of six 10-yd. motor trucks instead of any other type of transportation for delivery of spoil from the face of the quarry to the crusher. These same units gave satisfactory service under more difficult conditions, specially as to grades, in the excavation for the foundation of the main dam. Running over the rough surfaces of the excavation and the temporary roads leading to the dumps, from 2½ to 3½ months' service was obtained with the various makes of tires with which these trucks were equipped. This was on the basis



PLANT LAYOUT, showing relationship among conveyors and crushers, and (in insert, above) aggregate flow diagram, with capacities of units.

of normal operations 22 hr. a day, six days a week.

Crushing and Screening Plant—Run-of-the-shovel output as delivered to the 10-yd. trucks is fed directly by the latter into a 42-in. gyratory crusher that does the primary breaking of all of the quarry production. This crusher was placed approximately at the lower end of the transverse center line of the quarry. On account of the steep sidehill on which the quarry is located, it was desirable to have the crusher occupy as little space as possible. This was accomplished by using a 17-part Texrope drive between the crusher and the 250-hp. electric motor which runs it. With this setup the floor space needed was reduced to 16x16 ft.

On the opposite side of the steep narrow draw in which the quarry and primary crusher are located are the secondary crusher, the crushed rock sizing and storage plant and the equipment for producing sand. Leading from the primary crusher across this draw is a 36-in. belt conveyor on an overhead steel structure that leads to the head-tower in which the secondary crusher is placed. This 36-in. conveyor is in one length of 330 ft. It has a capacity of 300-tons per hour and is driven by a head pulley equipped to remove magnetically all tramp metal that may come from the quarry.

In an accompanying sketch is shown the flow sheet of aggregates from the 36-in. conveyor that delivers the entire output of the primary crusher right through to the mixing plant. First, a 6-in. vibrating scalping screen in the head tower of the secondary crusher delivers its rejects to the secondary crusher. The latter, which is a 5½-ft. shorthead cone unit, is set to reduce the material fed to it a maximum 3-in. size. Between the 6-in. vibrating scalping screen and the cone crusher is a 3-in. screen that also delivers its tailings either to that crusher, or directly to the conveyor leading to the sizing and storage plant beyond. This arrangement permits control of the production of smaller sizes as may be desired at the screening plant.

Output of the secondary crusher and the material passed around it all feed to a 30-in. inclined conveyor leading up to an overhead structure containing a series of conveyors, screens and feeders by means of which the reduced quarry output is sorted into four sizes. First comes a 3- to 6-in. grading, then 1½- to 3-in., next ¾- to 1½-in. and finally 4-mesh to ¾-in. All four sizes are separately stock-piled over a 6x6ft. concrete tunnel, 646 ft. long, in which a 30-in. belt conveyor provides means of reclaiming.

As shown by the flow sheet, any of the screens separating the three sizes, from 3 in. down, may be arranged to deliver to a horizontal conveyor in the overhead structure. This horizontal conveyor delivers in turn to an inclined conveyor leading to a surge bin in the sand-reducing plant. Ordinarily, the final screen in the overhead structure delivers to an inclined unit leading to the sand plant. But when more sand is needed than comes from this regular operation, then the provision for turning in all three or any one of the last three sizes regularly stock-piled takes care of the maximum needs.

Sand Producing Plant—Two sizes of sand are produced by reduction of the stone delivered from the screening plant. The coarse grade is 4- to 10-mesh, while the finer is 10-mesh down, with the dust removed. Two 42x48-in. Allis-Chalmers hammer mills are used for producing sand. This equipment was selected after extensive experiment to determine comparative cement requirements, workability and strength of concrete samples made with sand produced by various kinds of reducing equipment.

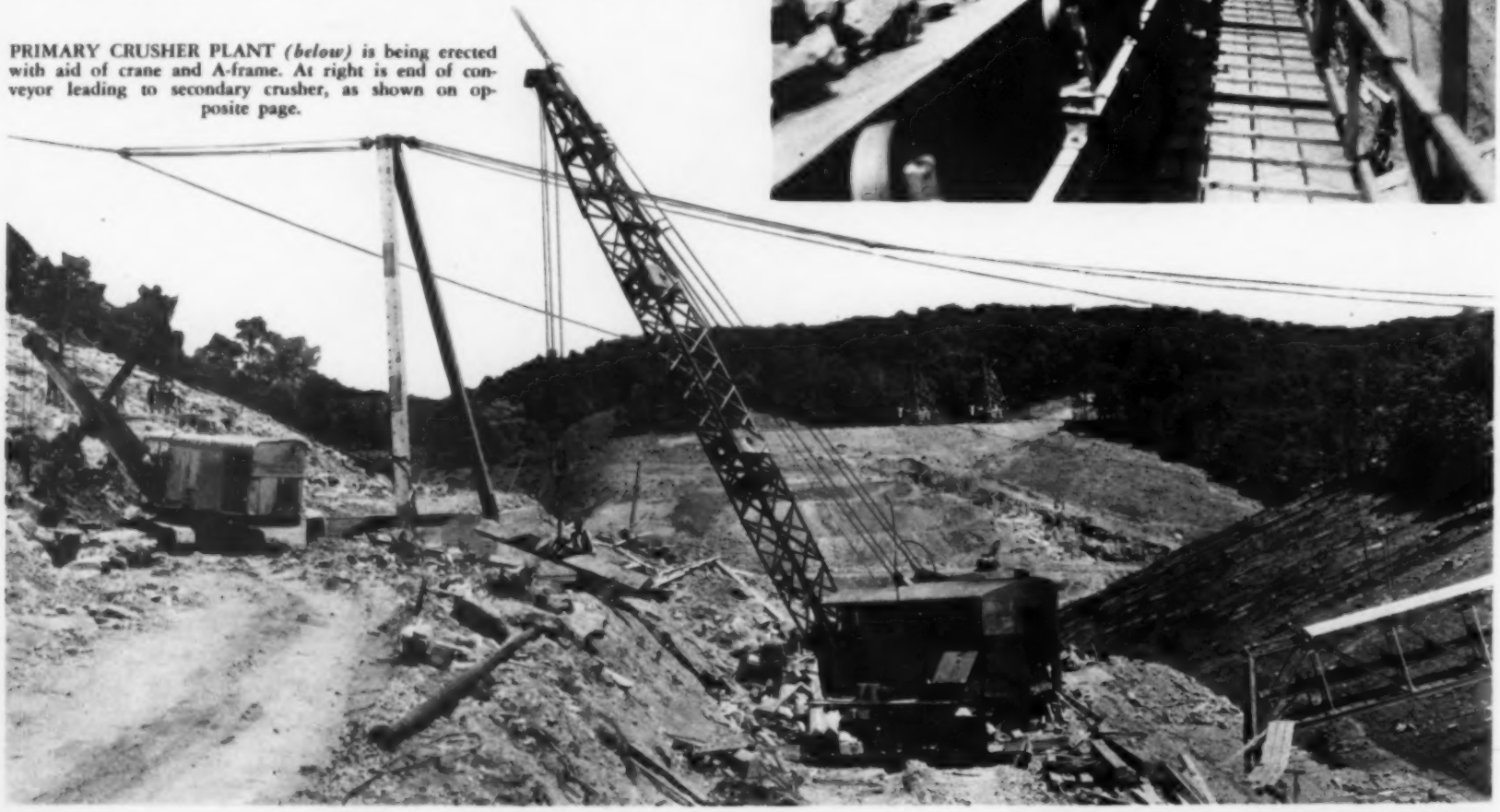
Some of the equipment also was set up experimentally on the job and operated before final decision was made. With the local stone the hammer mills turned out a product that was the most satisfactory, the sand being nearly cubical in shape and well graded. The only objection to the hammer mills is the amount of dust they occasionally produce. Tests indicate that with the local stone and the sizes of sand required the amount of dust that will have to be wasted will not exceed 4 per cent of the total run of the primary crusher of the plant. This dust will be wasted, unless a market is found locally for it.

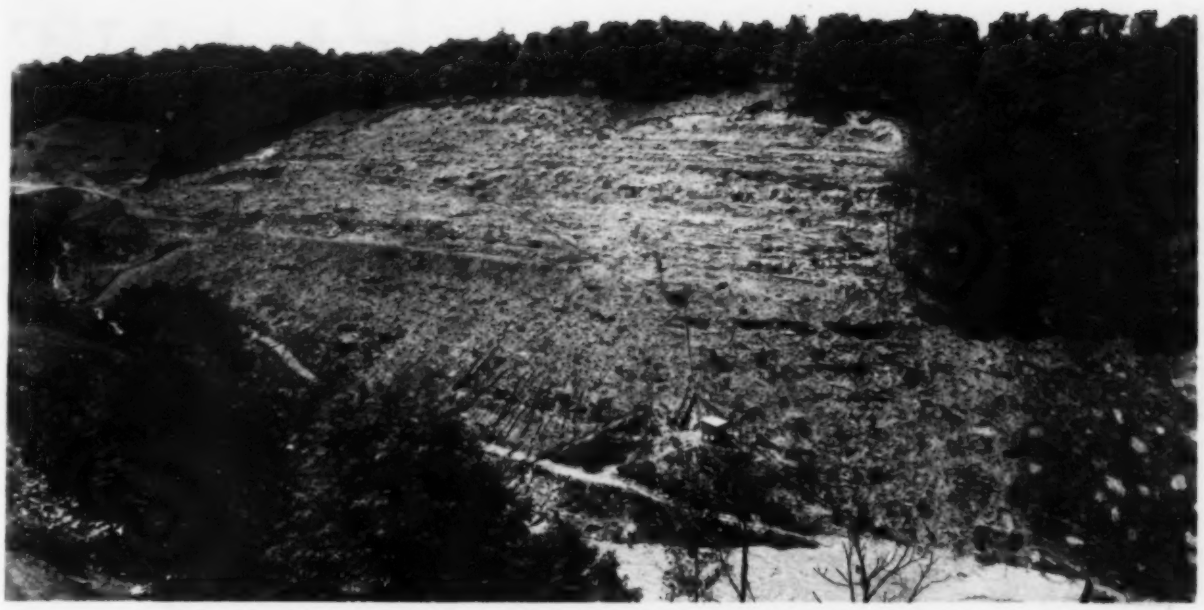
Output of the hammer mills of the sand plant is delivered to an inclined conveyor which feeds four double-deck vibrating screens equipped with 4-mesh and 10-mesh cloth. Tailings from the 4-mesh screen are returned to the hammer mills for further reduction. Output of these screens grading minus 4- to plus 10-mesh sand is delivered by belt conveyor to a fixed sand stacker that piles over the reclaiming tunnel. The remainder of the output of the screens goes either to a wet rotary classifier, or any part of the plus 10-mesh product may be returned to the hammer mills for secondary breakage. In this manner close control is maintained over the gradation of the final product.

Fines and waste from the classifier

INCLINED CONVEYOR *(below)* from end of reclaiming tunnel under stock piles delivering material to supply bins at mixing plant, with sizing and screening plant in background.

PRIMARY CRUSHER PLANT *(below)* is being erected with aid of crane and A-frame. At right is end of conveyor leading to secondary crusher, as shown on opposite page.





FACE OF QUARRY supplying aggregates for concrete has been stripped by hydraulic monitors and is ready for drilling to begin.

are discharged to a dump. The material delivered by the classifier that meets the minus 10-mesh sand specifications is stacked over the reclaiming tunnel by a radial conveyor. This radial stacker permits storing the sand in three piles so that while one is draining, another is being drawn off to the mixer plant and the third is being stored in continuous sequence.

Gates in the roof of the reclaiming tunnel permit the operator to draw from any desired stock pile overhead the size of material desired. The conveyor in the tunnel feeds another on an inclined structure leading to storage bins in the top of the four-deck structural steel tower in which the concrete proportioning and mixing plant is located. By means of electric signals the man stationed at the storage bins in the tower may advise the operator in the reclaiming tunnel the size of material needed, when to start and when to stop feeding.

Cement-Handling Plant — All cement for the 1,000,000 cu.yd. of concrete involved in the job will be delivered in bulk by mainline railroad to a point about 5 mi. from the mixing plant. Box cars in which shipments are received may be spotted twelve at a time on both sides of platform between sidings. Two portable pumps unload the cement directly from the cars to a 6,000-bbl. elevated steel silo. The pumps are shifted from car to car on the platform. Trucks drive under the elevated silo to receive cement by gravity. Semi-trailer type trucks equipped with 60-bbl. aluminum tank bodies are employed and are loaded in about 5 min. The design of the trucks permits the semi-trailer tanks to be disconnected and the tractors used for other hauling. Use of aluminum for tanks permitted an increase of about 10 per cent in the amount of cement that can be hauled per trip, as compared with steel tanks.

From the silo at the railroad to the mixing plant the trucks operate over the heavy-duty concrete road built by the TVA to service the project. For nearly 2 mi. the grade is up to 8 per cent, with the rest of the haul slightly down hill.

At the dam end of the concrete road and 230 ft. distant from the mixing plant is an unloading plant to which the tank-trucks deliver cement. The ground elevation at this unloading plant is about the same as that of the top of the storage bins in the mixing plant. The trucks drive over a dumping platform housed to protect the cement from the weather. Under this platform is a hopper that feeds either of two Fuller-Kinyon stationary pumps. These pumps may both deliver directly to the cement storage bins in the mixing plant through a 5-in. pipe suspended from a cable, or to an elevated 6,000-bbl. silo alongside the receiving hopper of the dumping platform. The silo feeds, when desired, into the hopper for delivery to the mixing plant.

At both the railhead and the dam the roadways at the cement handling plants are on loops to facilitate movement of the tank trucks. Storage at both ends of the haul also gives sufficient flexibility to take care of ordinary variations in shipment of cement or in operation of the mixing plant. The fleet of tank trucks may thus be in regular operation without regard to whether the mixing plant is running. Simple but effective precautions in the way of housing have been taken to protect the cement from atmospheric moisture due to the local high humidity at times and to the heavy rainfall of this region.

Personnel—A. E. Morgan is chairman and chief engineer of the Tennessee Valley Authority. C. A. Bock is assistant chief engineer, C. H. Locher is construction consultant and A. J. Ackerman is construction plant engineer. Barton M. Jones is construction engineer and C. D. Riddle is assistant construction engineer on Norris Dam, with Ross White, superintendent of construction, and F. C. Schlemmer and E. M. Whipple, assistant superintendents of construction.

Details of the mixing plant, the system of moving concrete from that plant to the cableways and operation of the latter will be described in subsequent articles.

FROM PRIMARY CRUSHER (on opposite page) belt conveyors lead to secondary crusher and thence to sizing and screening plant.

New Filtration Plant

First Self-Liquidating Project Approved by R. F. C.,

REPLACES OBSOLETE WORKS

at Conneaut, Ohio

FINANCED as the first self-liquidating project for which funds were made available by the Reconstruction Finance Corporation, the new municipal water filtration plant for Conneaut, Ohio, on the shore of Lake Erie, has been completed and was formally dedicated June 1, marking the culmination of several years' effort on the part of local city officials to replace an obsolete and insufficient plant, built in 1890, with one of modern design and adequate capacity.

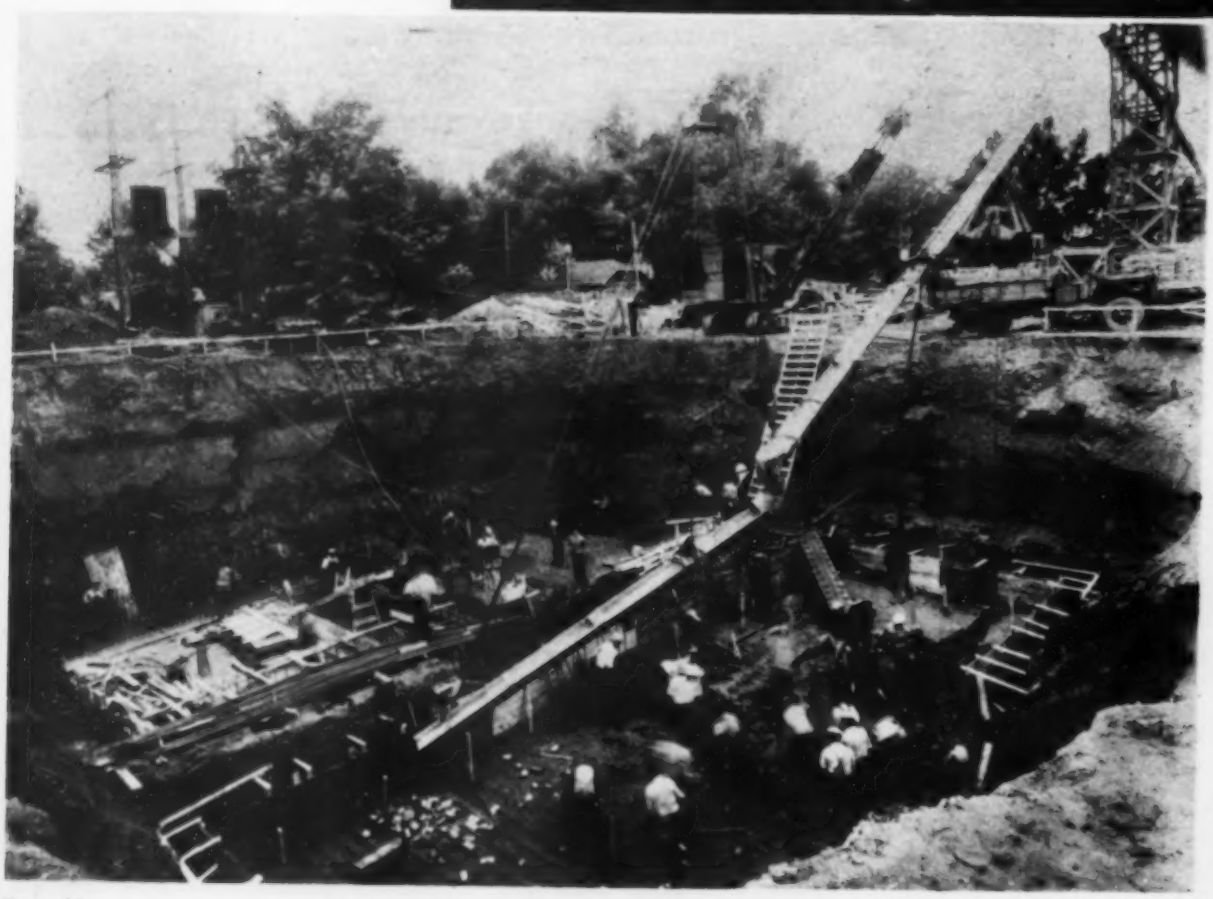
The new plant was designed by George B. Gascoigne, consulting sanitary engineer of Cleveland, to serve a future population of 15,000 persons at a maximum daily rate of 200 gallons per capita; the 1931 population of Conneaut was 9,700. Within recent years the relative economy of building an entirely new plant became evident, particularly since previous repairs had indicated that the construction cost would be only slightly greater than that of making the necessary repairs to the old plant and because a new plant at another location would afford a much better quality of raw water for treatment.

Three Contracts — The project for the new plant was divided into three major contracts, one for a submerged crib and intake, another for a filtration plant, and the third for a 500,000-gal. elevated tank. In addition, a 16-in. and 12-in. cast-iron force main connecting the new plant with the existing distribution system was built by day labor under the supervision of the waterworks superintendent.

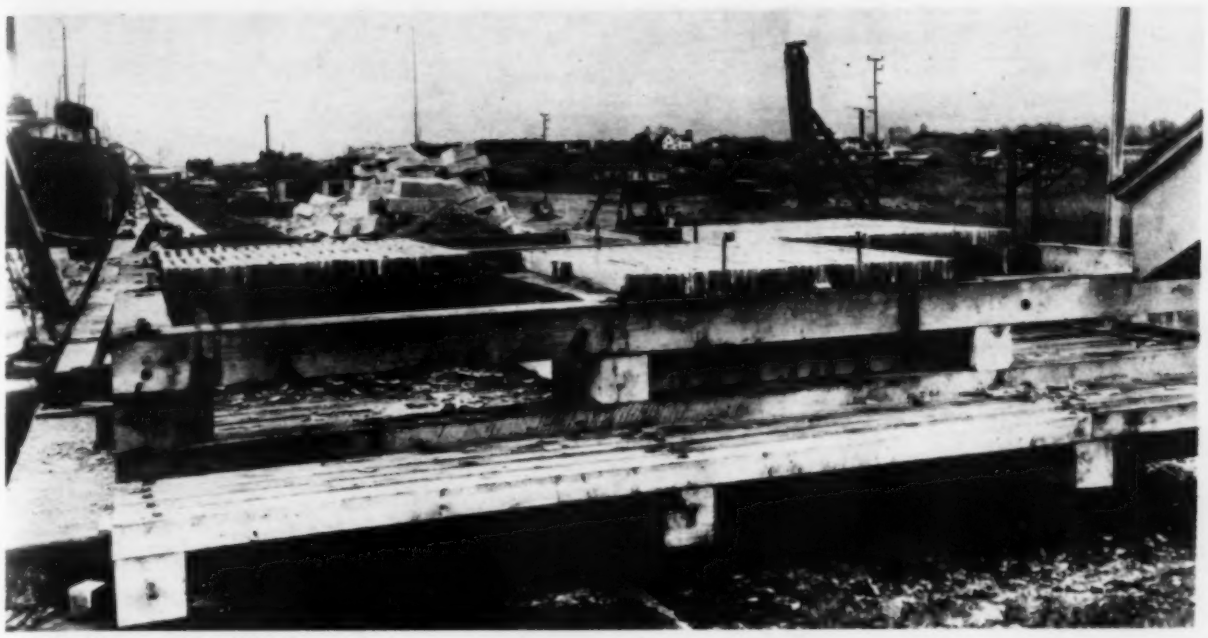
The intake crib is a submerged rock-filled structure located in water 15 ft. deep about 1½ mi. west of the mouth of Conneaut Creek. From the crib a 24-in. steel pipe intake, 1,900 ft. long, extends to shore, where connection is made with a low service pumping station.

For the filtration plant the principal structures include mixing chambers, two concrete sedimentation basins arranged for series or parallel operation,

INCLINED CHUTES, suspended from cables, deliver concrete from wooden tower to forms for floors and walls of filtration plant structures.



DEEP EXCAVATION *(left)* completed and work started on placing reinforcement and delivering concrete by inclined chutes.



HEAVY TIMBER FRAME is bolted up to form rock-filled intake crib.

MAIN FILTER BUILDING housing operating mechanism for new plant.

four filter units, each of 750,000-gal. per day capacity, clear-well storage under the filters and a main filter operating building. The filters are provided with underdrains of perforated pipe and each unit is 16x16½ ft. in plan. The entire plant has been laid out so that it can be economically enlarged to double its present capacity upon the present site without the necessity for purchasing additional land.

A stone breakwater, approximately 330 ft. in total length, was included in the intake contract as a protection for the low-service pumping station against possible damage from the lake during storms. Excavation for the low-service pumping station was in shale and the spoil was disposed of inside the new breakwater. Foundations for the settling basins are protected by steel sheet-piling, while those for the filter building are deep enough to encounter solid material.

The total cost of the project, including the new force main, was approximately $248,000. With $75,000 available from the sale of waterworks improvement bonds in 1931 and $200,000 obtained from the Reconstruction Finance Corporation, the entire work, including supervision and miscellaneous expense, has been completed within the preliminary estimate. The construction plan adopted by the contractor for the filtration plant involved the use of a tall wooden tower and a system of inclined chutes for delivering concrete to the floors and walls of the tanks and other structures.

Bids for the construction work were received May 20, 1933, and the filtration plant was placed in operation March 20, 1934, and has been in continuous service since that time. The entire charge of the work has been in the hands of a Waterworks Commission headed by Mayor L. R. Naylor and including A. L. Lamp, safety-service director. The feeder main from the new plant was installed under the supervision of Lee Harvey, superintendent of waterworks. The contractors for the intake and crib were Merritt-Chapman & Scott Corp.; for the filtration plant, Arthur G. McKee Co.; and for the elevated tank, the Chicago Bridge & Iron Works. For George B. Gascoigne, consulting engineer, Jasper W. Avery was in charge as resident engineer, and William L. Havens, associate, supplied the information on which these notes are based.

INTAKE PIPE is 24-in. steel line extending 1,900 ft. from shore to rock-filled crib.

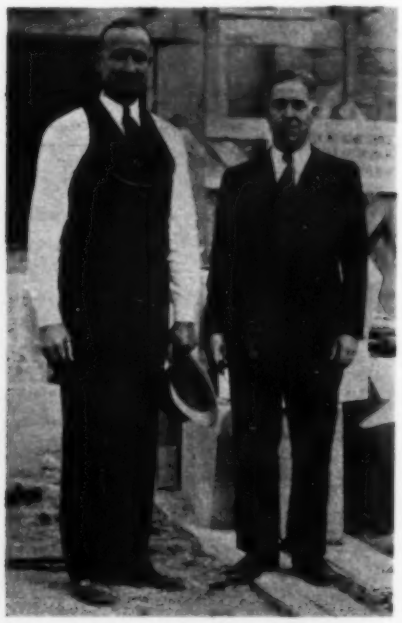
LONG-SPAN BRICK ARCHES

Clothe Steel Roof Trusses for Brooklyn Church

LONG-SPAN BRICK ARCHES carry brick walls concealing steel roof trusses.

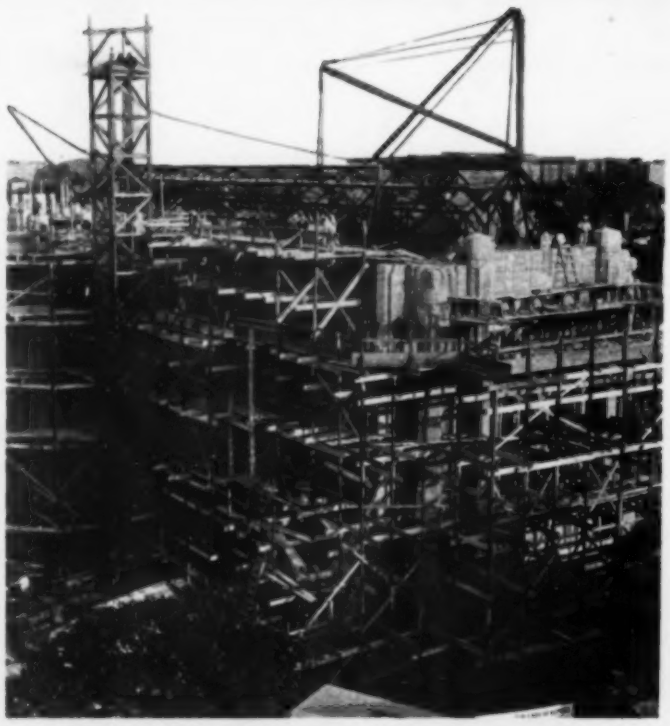
GRANITE FACING covers exterior walls of Brooklyn church distinguished on inside by unusual applications of brick for arches, wall covering and decoration.

J. H. LA DUKE (left, below), superintendent, and J. C. FINK, engineer, for Walter Kidde Constructors, Inc., general contractor.



ELEVEN pointed Gothic brick arches with clear spans of 39 ft. 8 in. are the outstanding structural features of Our Lady of Refuge Church, in Brooklyn, completed recently by Walter Kidde Constructors, Inc., of New York City. Although the brick arches, which are believed to be the longest ever built in this country, are the most prominent element of the interior decoration, they form only one part of an architectural scheme which employs brick to cover practically all exposed surfaces on the inside of the church. A wide variety of designs is executed with special hand-molded brick which were burned to give appropriate colors for the various purposes. Figured decorations on the walls, for example, are executed in relief with individual hand-molded units assembled to form a complete picture. The exterior of the church is stone.

Brick Interior—An effort was made in designing the interior to soften the appearance of the brickwork by eliminating all angular corners, such as the edges of door and window jambs and of nave and aisle arches. The edges of the brick construction were rounded by the use of specially molded hexagonal or splayed brick.



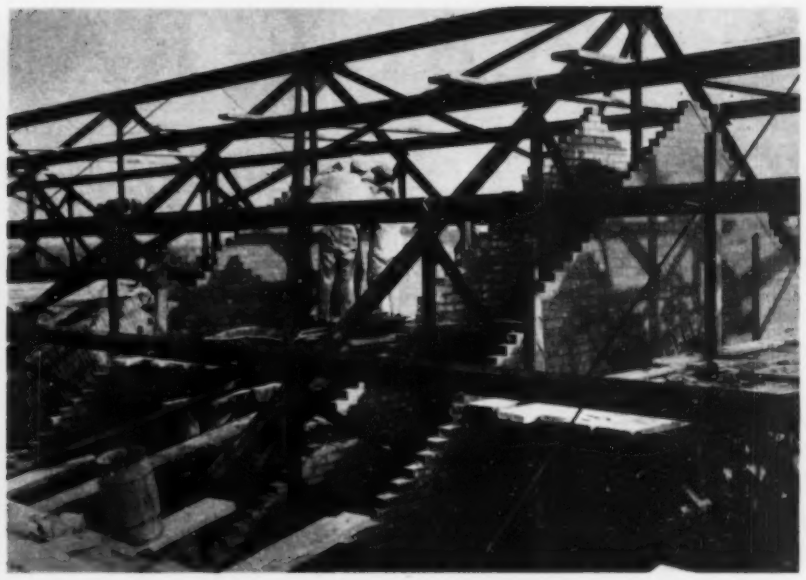
OUTSIDE HOIST delivers brick and mortar from street level to bricklayers working on high platform supported by interior scaffolding.

In the aisle arches, which are of comparatively short span, every brick is shaped as a key, a total of 10,800 special brick being required for these arches. In all, the brick interior of the church called for 432 individual shapes of brick, many of which were molded by hand. The total number of special-shape brick amounted to more than 110,000. In addition, about 200,000 ordinary face brick were utilized to clothe the interior.

Brick Arches—As shown by the accompanying drawing of the centering, the arches spring from their piers at a point 24 ft. above the floor and intersect at a crown 54 ft. above the floor. The thickness of the arch at the soffit is 1½ ft. This thickness is increased by three 4-in. offsets on each side to a final thickness of 3½ ft., 3 ft. above the soffit. Edges of the soffit and final offset are rounded by splayed brick.

Ordinary face brick were incorporat-

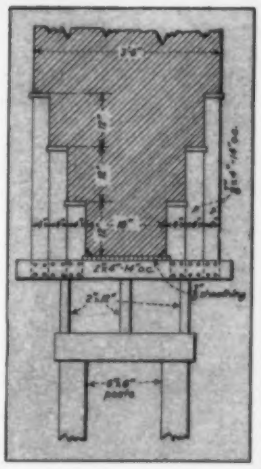
GOTHIC ARCHES with clear span of 39 ft. 8 in. and rise of 30 ft. are constructed of brick masonry.



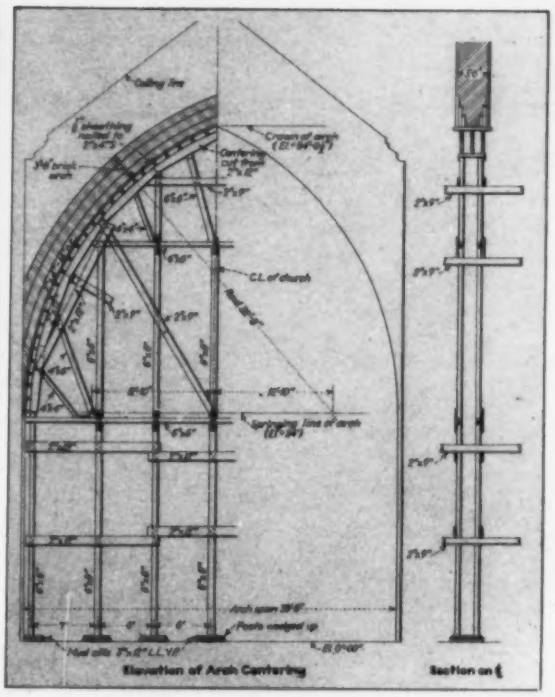
4-IN. BRICK WALLS are laid up on arches to inclose steel roof trusses of Brooklyn church.

ed in these main arches, the necessary keying of the structures being done by imperceptible tapering of the mortar in the joints. Only at the crown of the arch were special key bricks required. The face brick forming the arch ring were tied together with common brick which bond the arch into a solid unit. Upon the arch proper were built up two 4-in. walls of face brick to conceal the steel roof truss.

In addition to the eleven main trusses over the nave, the church has a 30-ft. truss above the sanctuary which was clothed with brick supported by an arch of similar design. Centering for all the brick arches consisted of double rows of 6x6-in. posts spaced as indicated by the drawing and braced in two directions. This falsework supported 2x12-in. timber segments shaped to the contour of the arch. To these centers were nailed a number of 2x4-in. struts, or cross pieces, which in turn supported the risers on both sides of the arch soffit needed to carry the brick offsets during construction.



OFFSETS IN ARCH *(above)* **are supported by 4x⅞ in. risers of proper length nailed to 2x4-in. cross pieces of centering.**



TIMBER CENTERING *(right)*, **supports brick arch during construction.**

Brick and mortar for the arches and other elevated brickwork were delivered from an outside power hoist to scaffold platforms. Each main arch required about 1,000 face brick in the soffit and about 5,600 face brick in the four rings of the two sides.

Supervision—In charge of the work for Walter Kidde Constructors, Inc., were C. W. Knowles, general manager of construction, J. H. LaDuke, superintendent, and J. C. Fink,, contractor's engineer on the job.

Henry V. Murphy, of Brooklyn, N. Y., was the architect. Representing Mr. Murphy at the church was H. C. Sherman, resident superintendent.

RISERS nailed to cross pieces of centering carry offsets in brick arch during construction.

CROWN OF COMPLETED ARCH. Offset supports have been removed, but main centering still is in place.

SPLAYED AND ROUNDED CORNERS of brickwork soften interior of church capped by tall Gothic arches.

SEAPLANE RAMPS *Fabricated by Electric Welding*

FIRST SEAPLANE LANDING RAMP launched at Brooklyn Navy Yard.

TWO FLOATING seaplane ramps 89x56 ft. in area anchored in the East River, New York City (one at the foot of Wall St. and the other at the foot of East 31st St.) now provide direct access to the business sections of the city for commercial and privately owned planes. The ramps are covered by wood decks resting upon five lines of steel trusses supported by cylindrical steel buoyancy tanks. In the deck is incorporated a 45-ft. diam. power-driven turntable by which the seaplanes can be revolved. The lower end of a ramp can be raised or depressed by mechanical control of pneumatic pressure in two buoyancy chambers of the outboard tank.

Electric-arc welding played an important part in the fabrication of the ramps, which were assembled and welded on launching ways in the New York Navy Yard, Brooklyn, by the Department of Docks of the City of New York with materials purchased by the city and labor paid for by the Temporary Emergency Relief Administration. The ramps originally were designed by United Dry Docks, Inc., in cooperation with the Edo Aircraft Corp. At the request of F. William Zelcer, commissioner of aviation in the administration of Mayor La Guardia, the plans were donated to the city by United Dry Docks, Inc. C. K. Pevear, consulting engineer, who had collaborated in the design of the turntable, gave his services as supervisor of construction.

Design of Ramps—Under the deck at the upper and lower ends of the ramps are the two main buoyancy tanks, both of which are 45 ft. long. The tank at the upper end is 12 ft. in diameter, and the one at the lower end has a diameter of 11 ft. In the larger tank, at the upper end, is installed all the operating machinery. The deck is clear of obstructions. A small pit above the machinery tank provides space for operating controls. The 45x11-ft. tank at the lower end of the ramp is divided into four buoyancy chambers. Water is admitted into or ejected from the two end compartments of this tank as the air pressure automatically diminishes or increases in accordance with any change in setting of a regulating gage.

A plane of 18,000-lb. gross weight can be handled on the ramps without difficulty. The 45-ft. turntable is rotated by a continuous cable wound around the circumference of the circle and reeved to a 10-hp. single-drum hoist engine. A 5-hp. compressor with a piston displacement of 24 cu.ft. per minute delivers air to two steel tanks about 5 ft. in diameter and 20 ft. long, one on each side of the ramp, which serve both as air receivers and as buoyancy tanks. All mechanical equipment is electrically driven.

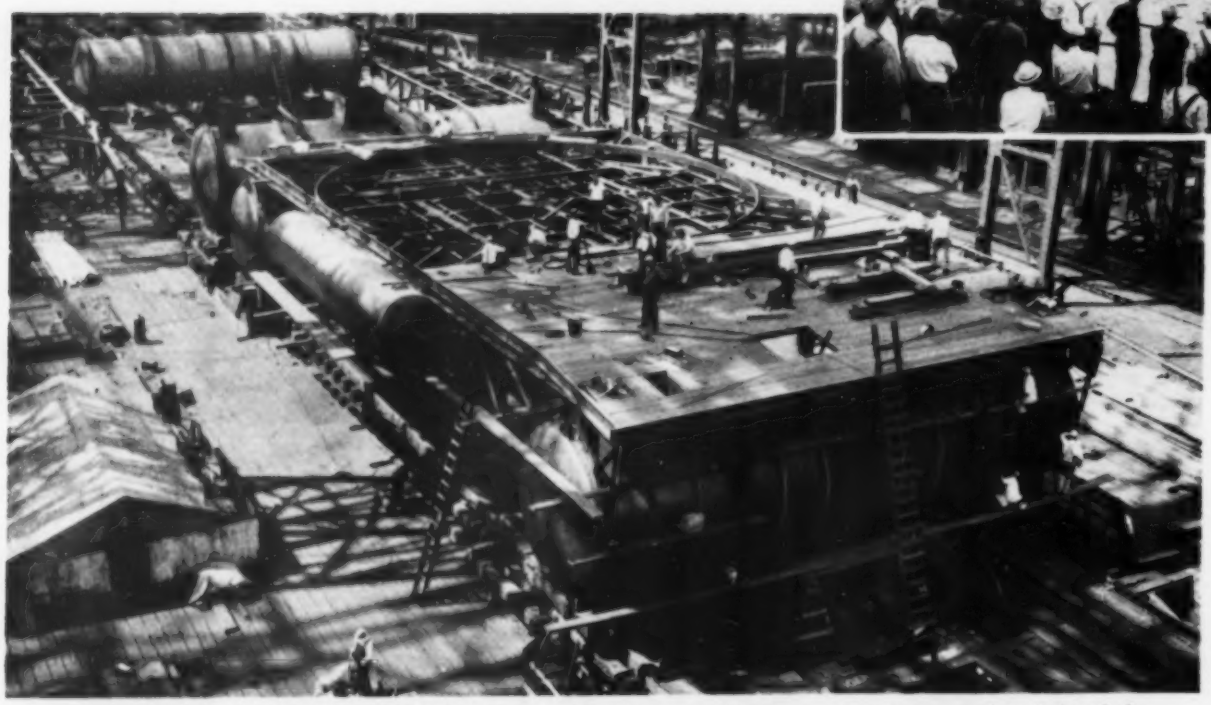
Five bolted and welded steel trusses 9 ft. deep with necessary transverse bracing support the deck and the turntable. Both bolt heads and nuts were spot welded to keep them from turning, and the connections between structural members and plates were reinforced with fillet welds. Steel angle reinforcing rings were welded to the main flotation tanks.

Welding Operations—Many of the welds had to be made in difficult locations which required building up of the weld, bead by bead, to make a fused joint between the two parts being welded. For vertical and down-handed work, the welding crew employed 3/16-in. uncoated steel electrode. Overhead welding was performed with 5/32-in. electrode. Total length of welding for one ramp amounted to about 6,000 lin. ft., according to the estimate of Tom Berg, foreman in charge of this work. Because of the thickness of some of the built-up welds, however, about 7,000 lb. of welding electrode was required for the fabrication of each of the two ramps.

The welding on this job was done by J. K. Welding Co., of Long Island City, N. Y., using twelve Lincoln 300-amp. 60-v. welding machines which supplied current for the 12 arcs used on this work. Two crews of twelve welders each worked two 7-hr. shifts per day. During the first three weeks, before the welding crew had been effectively organized, small progress was made in fabricating the first ramp. As soon as two shifts of skilled welding operators capable of passing the usual tests had been selected from among the men eligible to perform this work, progress was accelerated, and the first ramp was completed at the end of a six weeks' total fabrication period. The two skilled crews completed the second ramp in about four weeks.

Turntables for the two ramps were fabricated separately on level platforms and were set in place by overhead cranes. Each of the turntables is built up on a welded I-beam and channel frame, with five lines of circular track channels bearing upon 100 rollers supported by the truss framing. Both the turntable and surrounding deck are covered with 4-in. yellow pine decking.

Each ramp weighs about 168 tons. They were launched by sliding down the ways at the Navy Yard and were towed to their final position in the East River, where they were anchored and completed. A seaplane in landing runs upon the submerged portion of the turntable, which is about one-fourth under water, and then is revolved into the dry upper area of the ramp.



TWO FLOATING SEAPLANE RAMPS equipped with 45-ft. power-driven turntables incorporated in timber decks are fabricated on launching ways in Brooklyn Navy Yard. Two large cylindrical buoyancy tanks, reinforced with welded angle rings, support five welded steel trusses on which deck and turntable rest.

Present and Accounted For —

A Page of Personalities

RAY N. SPOONER, of the firm of Allen N. Spooner & Son, Inc., contracting engineers, of New York, is serving this year as president of the General Contractors' Association of New York City.

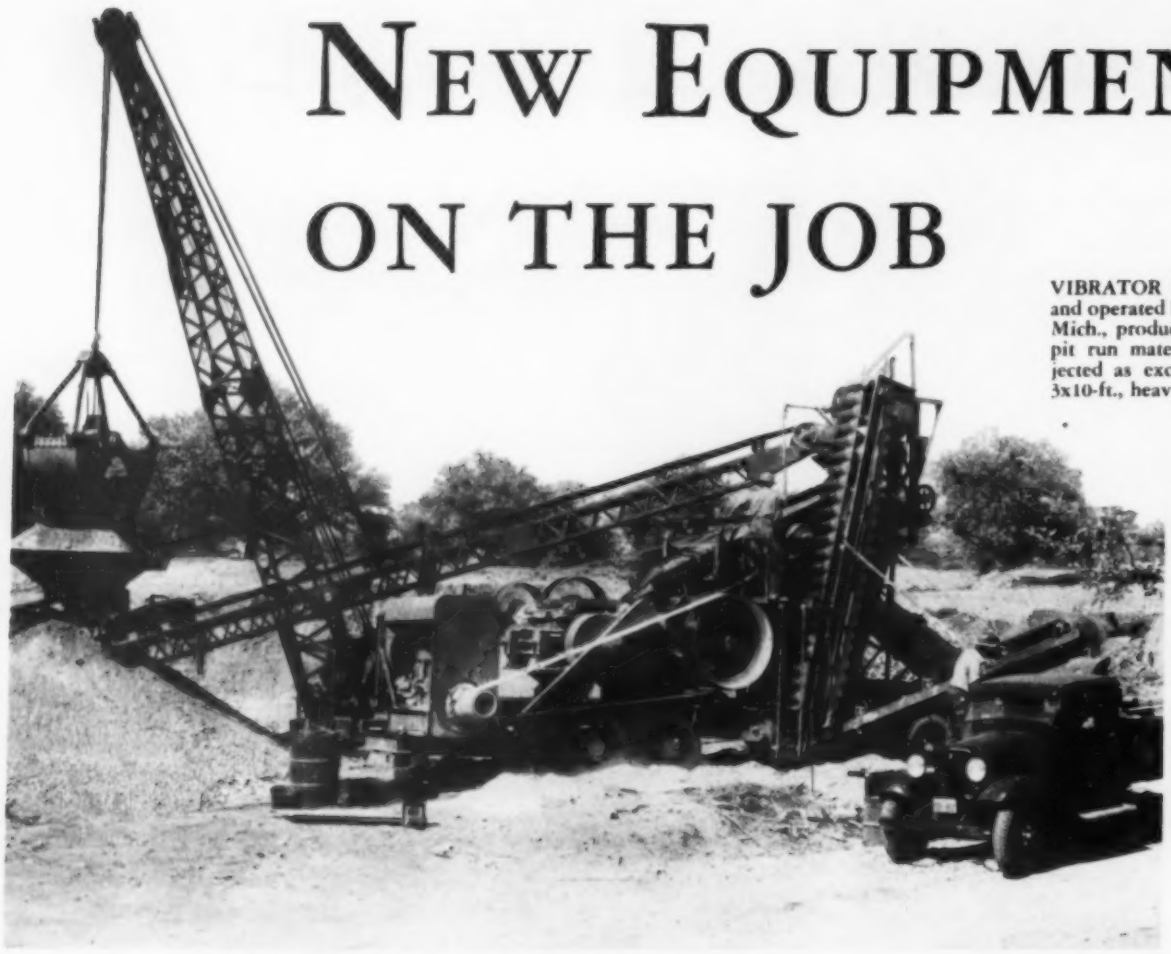
CHARLES R. GOW, of Warren Brothers Co., highway contractors of Cambridge, Mass., has been named as a contractor member of the National Planning and Adjustment Board provided for in the Construction Industry Code.

K. C. WRIGHT is the newly appointed chief engineer of the Utah State Road Commission, succeeding H. S. Kerr who resigned last spring. Since 1915 he has been identified with a variety of Western construction projects and was assistant to the chief engineer, and construction engineer for the state highway department of Utah before his recent promotion to chief engineer.

PRESTON G. PETERSON, member of the Utah State Road Commission, Salt Lake City, is the new president of the Western Association of State Highway Officials.

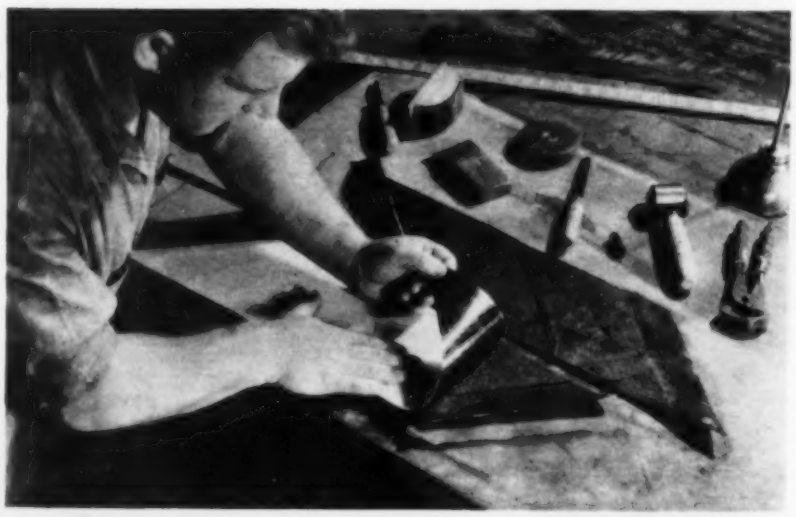
T. T. FLAGLER, president of the Flagler Company, engineers and builders, of Atlanta, Ga., has been appointed a member of the National Planning and Adjustment Board under the Construction Code to fill the vacancy created by the resignation of Louis J. Horowitz, of Thompson-Starrett Co., Inc., New York.

NEW EQUIPMENT ON THE JOB

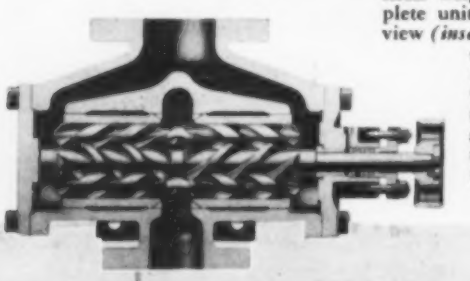


VIBRATOR DUPLEX CRUSHING PLANT *(left)*, owned and operated by West Michigan Construction Co., of Holland, Mich., produces average of 60 tons per hour, 30 per cent of pit run material being oversize and about 30 per cent rejected as excess fines. Material is fed on to lower deck of 3x10-ft., heavy-duty vibrator screen, tailings going to 8x36-in. jaw crusher, from which they are delivered to upper deck of screen. Tailings at this point pass to 24x18-in. roll reduction crusher where they are transferred by stub conveyor to bucket elevator and thence back to upper deck of screen. Finished product delivered to mixing hopper through side outlets in screen channels. Equipped with 50-ft. long 24-in. swivel-type feeder conveyor with shovel-type hopper and plate-type automatic feeder, a 20-ft. long 24-in. truck loading conveyor, folding bucket elevator and 80-hp. gasoline engine. Mounted on six dual solid rubber tires. — Pioneer Gravel Equipment Co., 1515 Central Ave., N. E. Minneapolis, Minn.

ENDLESS BELT *(below)* perfected by Fred G. Skeyhan by improved construction known as "Plylock Belt Joint," which overcomes tendency of outside seams to open up during severe service. Seam is embedded or countersunk below surface of belt in such position as to relieve strain and shield it from wear or windage. This protection is made possible by thick cushion of rubber reinforced with bias fabric permanently vulcanized into position.—B. F. Goodrich Co., Akron, Ohio.



HIGH-SPEED PORTABLE ROTARY PUMPING UNIT *(below)* mounted on trailer, when driven at approximately 1,675 r.p.m. by 60-hp. gasoline engine, delivers 90 gal. per minute against 495 lb. per square inch pressure with suction lift equivalent to 14 in. of mercury. Pump itself weighs 398 lb. Weight of complete unit, about 2,000 lb. Sectional view *(inset)* shows three working parts of pump, a central power rotor and two sealing rotors which mesh in such manner that liquid is carried through, as by continuously acting piston, without shock or pulsation.—De Laval Steam Turbine Co., Trenton, N. J.



CLOSE COUPLING FEATURE of new 300-amp., 40-v. gas engine driven "Shield Arc" welder *(right)* which produces more compact and lighter weight unit, is accomplished by mounting generator on engine housing with drive lined up on hardened steel and driven on cushioned rubber. This method of coupling takes care of any misalignment and reduces vibration, thus increasing efficiency of engine and lowering gasoline consumption. Other features: dual control of welding heat, sparkless commutation, handy-height controls and arc-welded steel construction.—Lincoln Electric Co., Cleveland, Ohio.

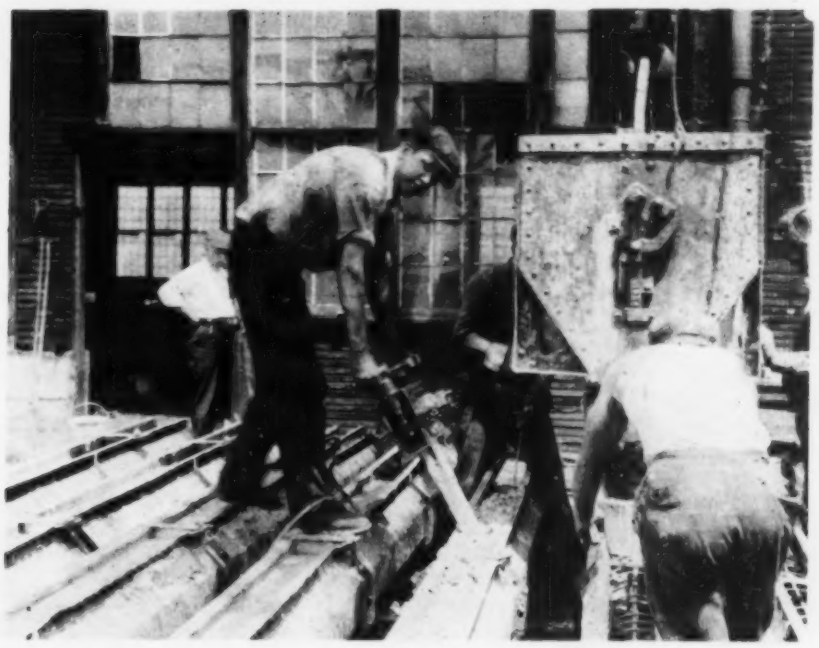
If You Want Further Information —

Within the space limits of this page it is impossible to present complete information about the products illustrated.

The manufacturers, however, will be glad to supply further details if you will write to them.

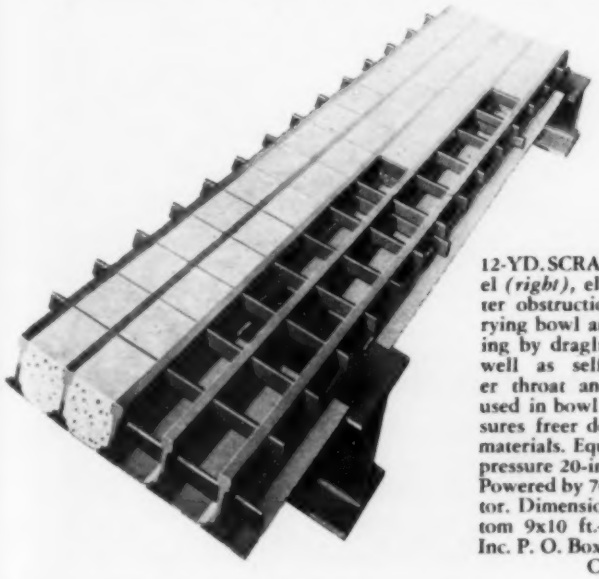
ROAD ROLLER *(right)* becomes pneumatic-tired trailer simply by lifting tongue "up and over" when change is desired. Light truck can haul it to next stretch of road, reducing roller costs especially on widely scattered jobs. Equipped with Firestone heavy-duty tires. — Wheeled Roller Corp., San Antonio, Tex.

PORTABLE BALL-BEARING ELECTRIC DRILL *(below)*, built in two models: one for maintenance work and the other a heavy-duty unit for use of general contractors, railroads and steel fabricators. Steel drilling capacity, ½ in. Operates on a.c. or d.c. current, 60 cycle, or less. Free speed 450 and 550 r.p.m. Aluminum die cast frame. Double pole, bakelite-enclosed switch, momentary contact for continuous operation. Gears of chrome nickel and other selected steels, heat treated. Length overall, 16 in. Net weights, 12¼ and 13½ lb. Recommended for driving Skilsaw hole saws.—Skilsaw, Inc., 3310-20 Elston Ave., Chicago, Ill.

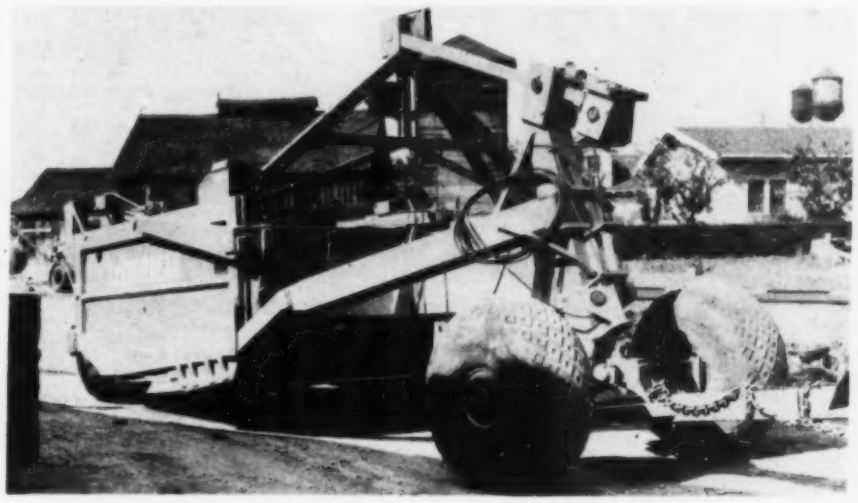


COMBINATION STEEL AND CONCRETE bridge roadway slab *(below)* or heavy-duty floor that is light in weight, more rugged and less costly developed by use of I-Beam-Lok armored construction. Consists of series of alternating I-beams and concrete ribs thoroughly tied and locked together by notched cross bars near top and bottom surfaces of slab, providing sufficient reinforcement for lateral distribution of loads. When filled with concrete, slabs weigh only 47 lb. per square foot in 3½-in. depth. Provides armored road surface, minimizing wear and skidding. Units available in 2, 3 and 3½-in. depth.—Carnegie Steel Co., Pittsburgh, Pa.

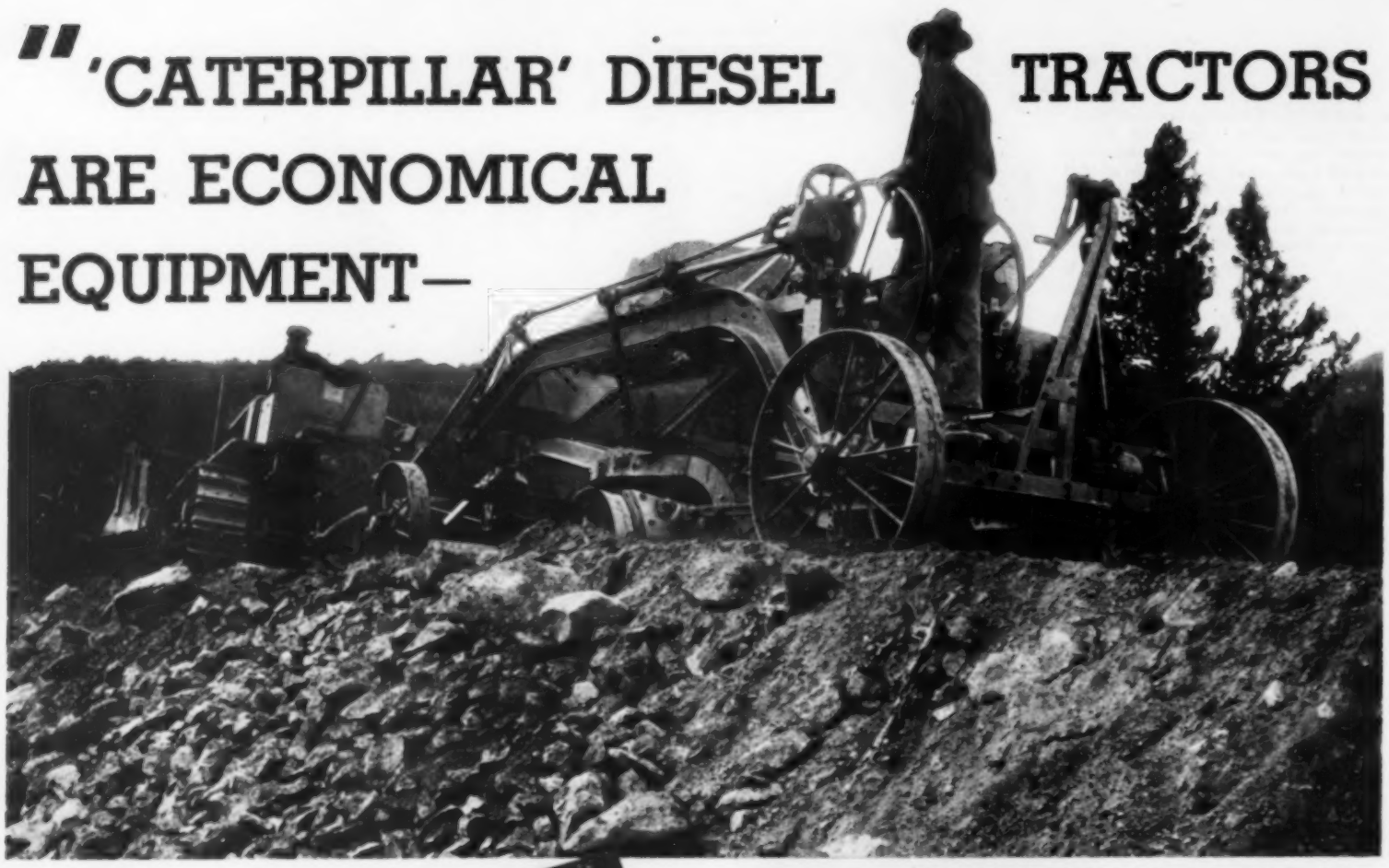
ELECTRO-MAGNETIC VIBRATOR, for producing greater density, higher strength and smoother surfaces in concrete construction, consists of coil wound electro-magnet with an air gap between core and armature held open by springs. By special patented principle of changing alternating to pulsating current, this air gap is closed and opened every cycle of current, and heavy mass of armature moving at such high speed causes positive flow of powerful vibrations which may be applied to concrete. May be equipped with puddling board and also with spud for placing concrete against reinforcing and forms. Vibrator may be clamped directly to forms, if desired, or under vibrating platform for manufacture of precast concrete units. Made in various sizes, depending on purpose of vibration and character of material. Operates from single phase, 110-v. alternating current. — Syntron Co., Pittsburgh, Pa.



12-YD. SCRAPER, latest model *(right)*, eliminates all center obstructions through carrying bowl and permits loading by dragline or shovel as well as self-loading. Larger throat and higher apron used in bowl construction assures freer delivery of sticky materials. Equipped with low pressure 20-in. diameter tires. Powered by 70- to 80-hp. tractor. Dimensions of bowl bottom 9x10 ft.—Le Tourneau, Inc. P. O. Box 1290, Stockton, Calif.



"'CATERPILLAR' DIESEL TRACTORS ARE ECONOMICAL EQUIPMENT—



Platt-Rogers Construction Company uses the economical "Caterpillar" Diesel — and a "Caterpillar" Grader—on this road-building job into Estes Park, Colorado.

Building a new road in the state of Washington, near Seattle, three "Caterpillar" Diesel Seventy-Five Tractors are operating at a fuel cost for each tractor of less than 15 cents an hour.

THE MOST ECONOMICAL MANUFACTURED FOR USE IN EITHER BUILDING OR MAINTAINING ROADS," SAYS FLETCHER SENN, SUPERVISOR OF CALHOUN COUNTY, SOUTH CAROLINA

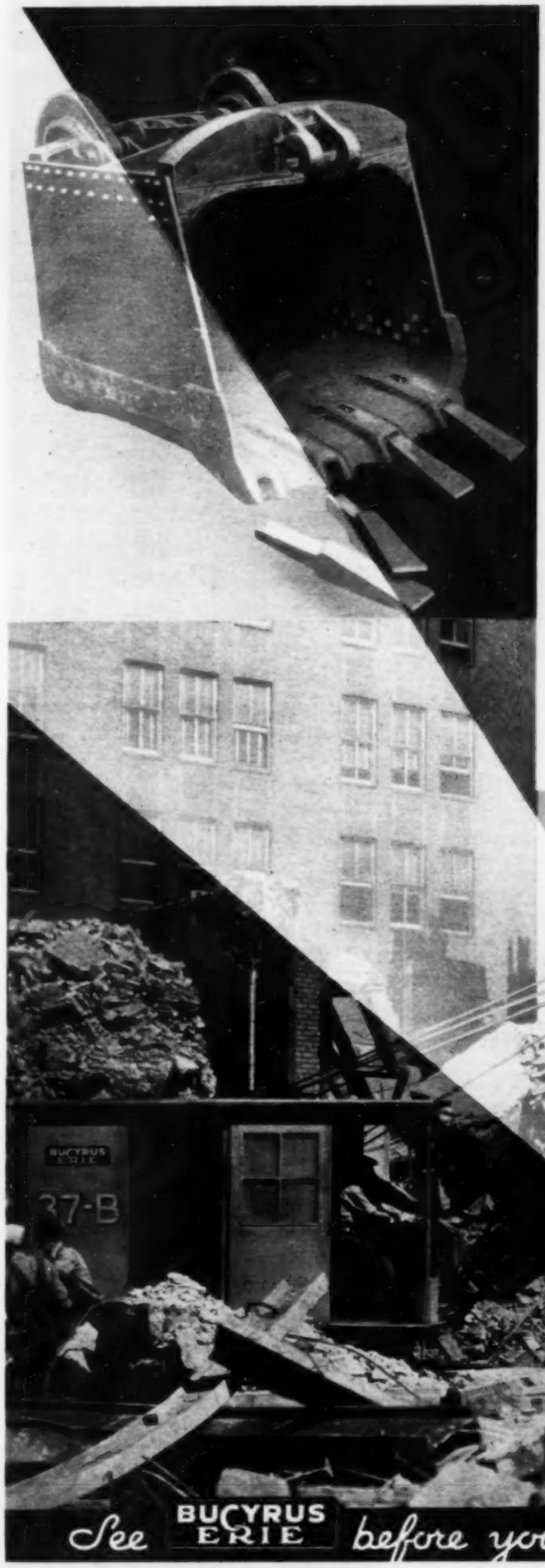
AMERICA GOES DIESEL

Night and day, these "Caterpillar" Diesel Seventy-Fives serve Contractor D. McDonald on the Junipero Serra Highway construction job in California.

The "Caterpillar" Diesel story is spreading far and wide. Into the big construction camps. To road jobs of states, counties, townships. Into foreign lands. Wherever power users seek economy and dependable performance to bring them the advantage of lower costs.

With the economy of a full Diesel engine that operates on low-price fuel and less of it, "Caterpillar" has linked simplicity, ease of operation, endurance, sure starting. More than 3500 "Caterpillar" Diesels are now in use. Ask where you can see one at work. Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

Save with the Upkeep Economy of Modern Bucyrus-Eries



Operation of obsolete machines is an extravagance few users can afford today. High repair costs go hand in hand with expensive time and output losses.

Look at a modern Bucyrus-Erie. Note the many money-saving, upkeep-economies . . . the convenience and minimum expense required when replacements become necessary. For example, the inserted-tooth dipper. Its cast front gives unusually long wear, can be easily replaced. The teeth are forged from high-carbon steel . . . can be resharpened by any blacksmith. Reversible, they give wear on both sides. They do not spread in rock digging . . . will not work loose. You get no chattering nor the excessive wear that accompanies it. Changing teeth is conveniently and quickly done.

For digging ability and upkeep economy, compare this famous Bucyrus-Erie inserted-tooth dipper with other dippers.

BUCYRUS-ERIE COMPANY
South Milwaukee, Wis.

783

WARNING! DON'T TAKE CHANCES ON TRUCK TIRE FAILURES

Get this Goodrich Triple Protected Tire

It's the sidewall "Failure Zone" that runs up tire bills and trucking costs. Many tires blow out in the sidewall long before the tread is worn. Jobs are delayed. Tires are ruined. Trucks and men stand idle.

So Goodrich built a truck tire with Triple Protection against "Failure Zone" blow-outs. Here's a tire that's just as strong in the sidewall as it is under the tread—a tire that offers positive protection against 80% of all premature tire failures!!

You can't afford tire failures on concrete mixers. Or on any construction job, for that matter. Play safe. Get Goodrich Triple Protected Silvertowns. On actual road tests this new invention proved that it made tires many times safer from sidewall failures!

Where loads are heavy and roads are poor, you get more mileage if you use Triple Protected Silvertowns. You forget about unnecessary failures. Cut down on lost time. Save money. And you always have sure-footed traction. Yet you pay not one cent extra for these tires.

FREE! Trucker's Handbook

Write today for your free copy of "The Truck Operator's Handbook," full of valuable truck tire data that you can put to immediate use. No obligation. Address Department T-137, The B. F. Goodrich Company, Akron, Ohio.

See your Goodrich truck tire dealer. Ask him to show you how these three exclusive Goodrich features positively check 80% of premature failures:

1 **PLYFLEX**—a *new*, tough, sturdy rubber material with greater resistance to stretch. A layer of Plyflex in the sidewall distributes stresses and strains—prevents ply separation—checks local weakness.

2 **PLY-LOCK**—the new Goodrich way of *locking* the plies about the bead. Anchoring them in place. Positive protection against the short plies tearing loose above the bead.

3 **100% FULL-FLOATING CORD**—Each cord is surrounded by rubber. With ordinary cross-woven fabric, when the cords touch each other, they rub—get hot—break. In Silvertowns, there are no cross cords. No friction.

Goodrich *Triple Protected* Silvertowns
FOR TRUCKS AND BUSES

POWER *plus*

INSTANT AVAILABILITY

FOR ANY HAMMER JOB

Power is one of the first considerations in the selection of a hammer. The BARCO GASoline HAMMER has power and more. It has rugged individualism; it works alone with only the operator to guide it and a little gasoline and a small dry cell to take the place of a compressor. Carry it anywhere with the rest of the tools; use it whenever necessary and as long as necessary.

The BARCO GASoline HAMMER

is the only power hammer which can be instantly transported and is immediately ready for work when it arrives on the job. It operates at a total cost not exceeding 20c per hour. Its sturdy construction assures the employment of its full power on every job which faces the Contractor, the Public Utility Corporation, or the Municipal Street Department.

The BARCO GASoline HAMMER occupies little storage space—hardly more than the ordinary pickax or sledgehammer. The largest size weighs but 89 pounds. It is the ideal auxiliary hammer because of its wide utility for breaking — for back-fill tamping — for road patching—for shallow drilling—for sheet driving—etc.

The BARCO GASoline HAMMER is a proven success—its reputation assured by satisfactory service on the most exacting jobs.

Write us for the proof in the testimonials of public utility engineers and prominent contractors. Address the home office for full details and the name of the distributor in your territory.

Extreme Portability

BARCO MANUFACTURING COMPANY

1801 Winnemac Avenue, Chicago, Illinois

Proved by Actual Performance Facts

Pouring the Concrete for Two Giant Tennessee Valley Dams

G-E MOTORS AND CONTROL GIVE CONTRACTORS THE ECONOMY AND RELIABILITY THESE JOBS REQUIRE

Left — View of one of the Lidgerwood cableways at Norris Dam. These cableways are equipped with G-E 400-hp. wound-rotor motors and G-E control. Equipment also includes four G-E 75-hp. tower-shifting motors, with controls for keeping the towers in position as they move along tracks

THE confidence experienced engineers place in General Electric equipment for construction jobs is again demonstrated by the selection of G-E motors and control for the machinery that will pour the concrete at both the Norris and the General Joe Wheeler Dams in the Tennessee Valley.

At the Norris Dam the concrete is being poured from the buckets of two Lidgerwood cableways, completely G-E equipped. At the General Joe Wheeler Dam the concrete-pouring job is being handled by Clyde Wiley-Whirleys, also completely equipped with G-E motors and control.

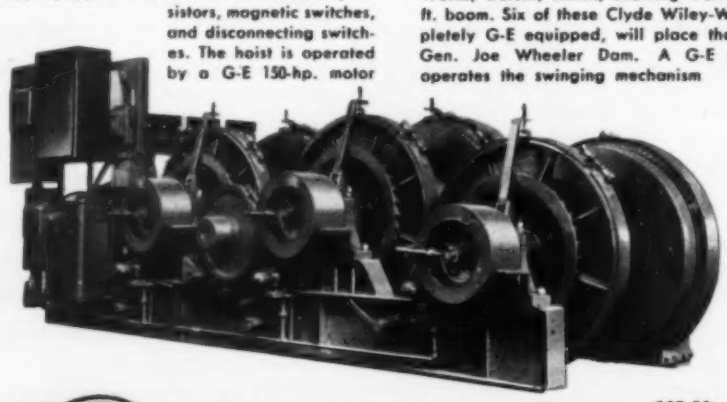
Motors and control on jobs like these must stand up and deliver efficient service under the strain of day and night operation. General Electric equipment—because of the high quality of its materials and workmanship, plus correctness of design—can be counted on to give dependable, trouble-free service under severe conditions.

Economy is also of prime importance to the contractor. Because G-E motors and control are carefully designed to match the requirements of each specific job, their operating costs are low. Furthermore, their high quality assures long life and low maintenance.

These are the reasons so many engineers today—to reduce costs and increase profits—specify G-E equipment for every type of construction job. Before starting your next job, call in one of our engineers and let him show you how General Electric can help you speed your work and save you money. General Electric Company, Schenectady, N.Y.

Above—Clyde Wiley-Whirley, built by Clyde Iron Works, Duluth, Minn., showing frame without 95-ft. boom. Six of these Clyde Wiley-Whirleys, completely G-E equipped, will place the concrete at Gen. Joe Wheeler Dam. A G-E 40-hp. motor operates the swinging mechanism

Below — Main electric hoist of the Clyde Wiley-Whirley, equipped with G-E drum controllers, resistors, magnetic switches, and disconnecting switches. The hoist is operated by a G-E 150-hp. motor



020-83

GENERAL ELECTRIC

See What Others Are Doing with this Versatile Power

Backed by the **WORLD'S LARGEST TRACTOR BUILDER** *and a Country-wide Network of* **McCORMICK-DEERING SERVICE**

Above: The T-20 TracTracTor in a logging operation. The round hand-hole plates visible at the rear are a feature of TracTracTor accessibility.

Above: The new McCormick-Deering Model I-12 industrial tractor, maneuvering a giant of the air at a municipal airport. This compact tractor offers speeds of from 2½ to 10¼ m. p. h., and ample power for airport, park, estate, and golf course (Fairway 12) requirements.

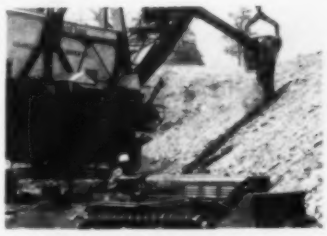
Above: The Model I-12 industrial tractor hauling a train of lumber dollies. Here is efficient power for railroads, lumber yards, woodworking shops, etc.

Above: A leading brewery moves freight cars and performs many other tasks with this powerful Model I-30 industrial tractor.

Above: The McCormick-Deering Model T-40 TracTracTor at work on a dirt road job This big crawler provides ideal power for road building and maintenance work, including snow removal.

At Left: A railway company uses this crane-equipped Model I-30 industrial tractor in maintenance work.

Above: A 25 h. p. power unit installation in the oil country. This efficient engine operates on natural gas and pumps three wells simultaneously.



Above: This T-40 TracTracTor and bull-dozer outfit helps to operate a strip coal mine profitably. Built with 6-cylinder gasoline engine and 4-cylinder Diesel engine.

Above: A 35 h. p. power unit operating a saw mill. Hundreds of outfits like this are at work, with good records to their credit.

Above: A McCormick-Deering-powered locomotive... an ideal unit for use in mine, quarry, clay pit, sand and gravel pit, etc.

Above: A 52 h. p. Diesel power unit operating a big gravel plant at remarkably low cost.

BUSINESS MEN are studying power costs today as never before. Burdens that had to be shouldered by industry in other days are being sidestepped with increasing frequency by men who have discovered this key to economy—*McCormick-Deering Power.*

Perhaps you have a power job that needs analyzing... that can be done better with *McCormick-Deering Power.* If so, the nearby McCormick-Deering distributor or International Harvester branch will be glad to consult with you.

McCormick-Deering Power is available in the form of power units, wheel tractors, crawler tractors, and modifications of these types.

Write for specific information on industrial power and equipment.

INTERNATIONAL HARVESTER COMPANY of America *(Incorporated)*
606 So. Michigan Ave. Chicago, Illinois

At Left: The radio-controlled tractor featured in the International Harvester exhibit at the World's Fair, Chicago, performing before the news-reel camera. The compact design and short-turning radius of the "12" series tractors are emphasized in this driverless demonstration.

McCORMICK-DEERING INDUSTRIAL POWER

ONE CHEVROLET TRUCK USUALLY LEADS TO ANOTHER

These Experienced Operators Replace Chevrolets with More Chevrolets

200,000 MILES . . . In 1930 we purchased a Chevrolet truck which has been hauling freight loads of 4 to 9 tons on the truck and 4-wheel trailer. It traveled 114,000 miles before requiring a major motor overhaul. It has now traveled over 200,000 miles. I purchased another Chevrolet truck in 1933, *a new 1934 Chevrolet truck* the first part of this year, and I have placed my *order for another 1934 Chevrolet* truck with semi-trailer.

H. F. Reilley, General Manager, California Fireproof Storage & Transfer Co.

125,000 MILES . . . The Chevrolet 1933 tractor-truck I am now operating has never stopped in 125,000 miles over a period of 11 months and is now running on its original rings. I have had the valves ground twice. I have experienced a 12-mile-per-gallon gas consumption over this period. Within the next few days I will give you an *order for a new 1934 model* for immediate delivery.

H. N. Craig, Merchants Parcel Delivery Co., Terre Haute, Ind.

100,000 MILES . . . I am enclosing a photograph of one of the Chevrolet fleet I bought in 1929. This truck has gone over 100,000 miles, at the present time is covering a route of 100 miles a day. Because of such performance, *I have placed an order for 12 more.*

G. L. Scheer, Scranton, Pa.

150,000 MILES . . . The 1929 Chevrolet truck I am trading today has been driven more than 150,000 miles in 4½ years. Nothing was ever done to the motor except the replacement of a coil. *The 1934 Chevrolet truck I am buying today is our 9th one.*

C. R. Bevers, White Star Laundry, Durham, N. C.

CHEVROLET Chevrolet truck owners themselves offer the best evidence that Chevrolet trucks give exceptional satisfaction. They usually order new Chevrolet trucks to replace old equipment, convinced by personal experience of Chevrolet economy, dependability and long life. Their loyalty is rewarded, for each year Chevrolet trucks give increased hauling satisfaction. The 1934 line of Chevrolet trucks provides many new improvements for efficient hauling, full truck strength in every part, and the welcome economy of six-cylinder, valve-in-head engine design. So many truck owners standardize on Chevrolet equipment that it will pay every firm to investigate the reason. You can handle every load at minimum cost for gasoline, oil and upkeep with low-priced Chevrolet trucks.

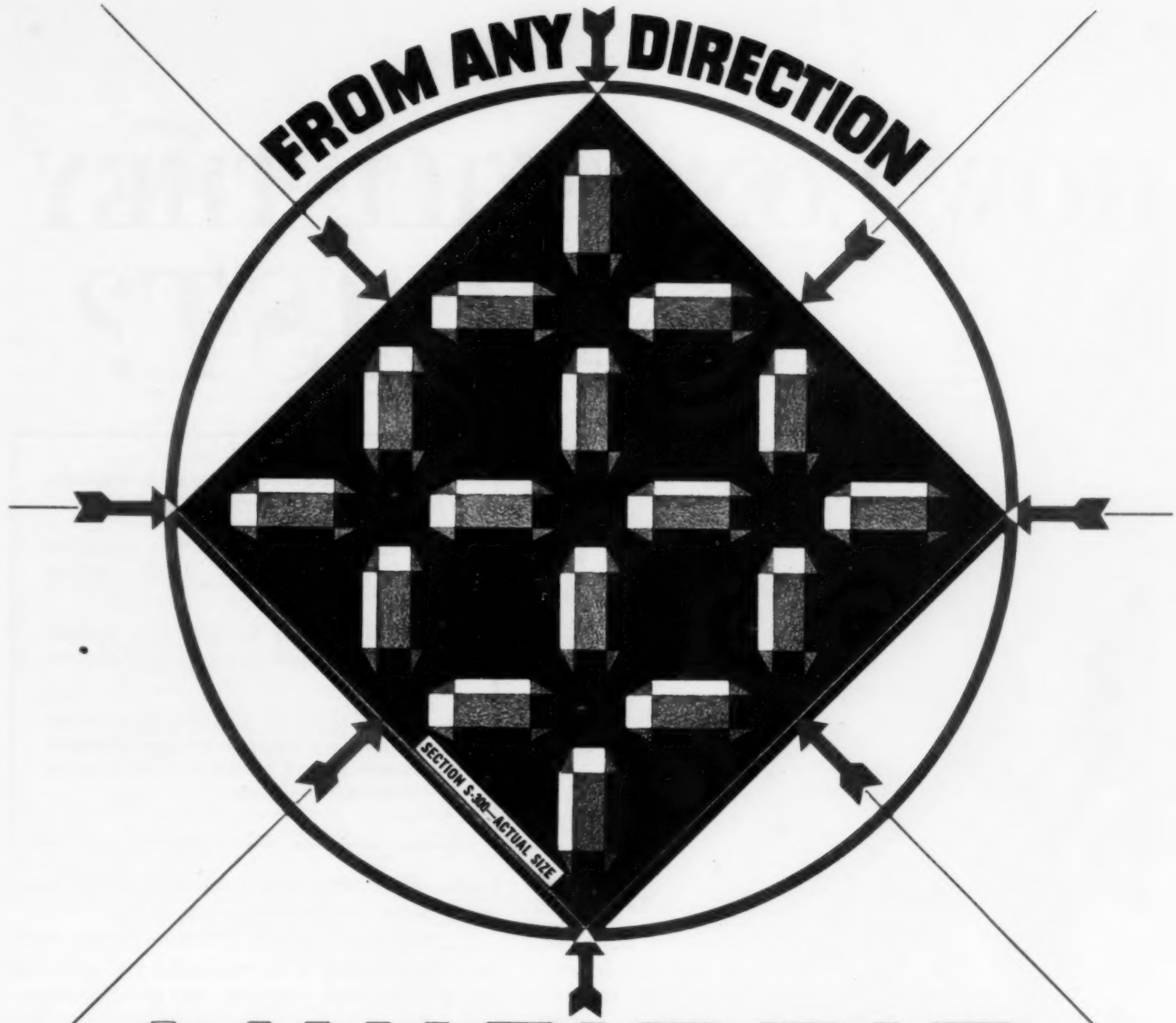
CHEVROLET MOTOR COMPANY, DETROIT, MICHIGAN

Compare Chevrolet's low delivered prices and easy G.M.A.C. terms
A General Motors Value

CHEVROLET

SIX-CYLINDER VALVE-IN-HEAD

TRUCKS



MULTIGRIP
FLOOR PLATE
IS NON-SKID

● Note the arrangement and spacing of the lugs on this new product of Illinois Steel Company. This design assures skid resistance at all angles.

- Improved resistance to skid
- Safe—wet or dry
- Comfortable under foot
- Easy traction for wheeled vehicles
- Easy to clean • Drains readily
- Attractive and modern in appearance
- No cutting waste

For protection to life and limb, specify Multigrip Floor Plate

MANUFACTURED BY

Illinois Steel Company

208 SOUTH LA SALLE STREET, CHICAGO, ILLINOIS

SUBSIDIARY OF THE UNITED STATES STEEL CORPORATION

HOW LONG WILL THEY LAST?

When routes US-25 and US-42 outside of Cincinnati, Ohio, were recently widened into a four-lane superhighway, this and several other veteran Armco culverts were extended and continued in service.

WHEN anyone claims that a certain type of culvert or drain is permanent or will last longer than others, ask him for specific evidence. Ask what he means by "permanence" and what degree of permanence is really desirable.

The Armco representative is prepared to answer your questions and give you evidence. He will show you:

1. Many thousands of Armco Ingot Iron culverts have been serving satisfactorily under practically every service condition and under the highest type road surfaces for 20 to 28 years. And they are good for many more years under normal service conditions.

2. Today, the major activity of many highway departments is the relocation and widening of highways built less than two decades ago.

3. Armco culverts do not become obsolete, but can be extended or removed and re-used, as they have been in hundreds of cases.

With Armco Paved Invert Pipe you are assured of even greater durability, because it has a tough bituminous pavement in the bottom to resist wear. It has a service record of nearly nine years to date, thus demonstrating the economy of this extra protection.

Let the Armco man prove these claims with ample evidence.

Fair questions to ask before choosing any culvert:

1. What is the actual service record of each type of culvert under various service conditions?

2. Based on past history, how permanent are the location and width of your roads?

3. Which types of culverts does experience show are likely to become obsolete monuments, and which can be adapted to changing conditions?

ARMCO

PAVED INVERT PIPE

— FOR HIGH-TYPE ROADS

ARMCO CULVERT MFRS. ASSOCIATION
Middletown, Ohio

☐ I am interested in evidence on culvert durability.

Name .....

Address .....

City .....

I am ☐ engineer ☐ contractor
☐ official ☐ student

CM 9

To Battle Arctic Ice

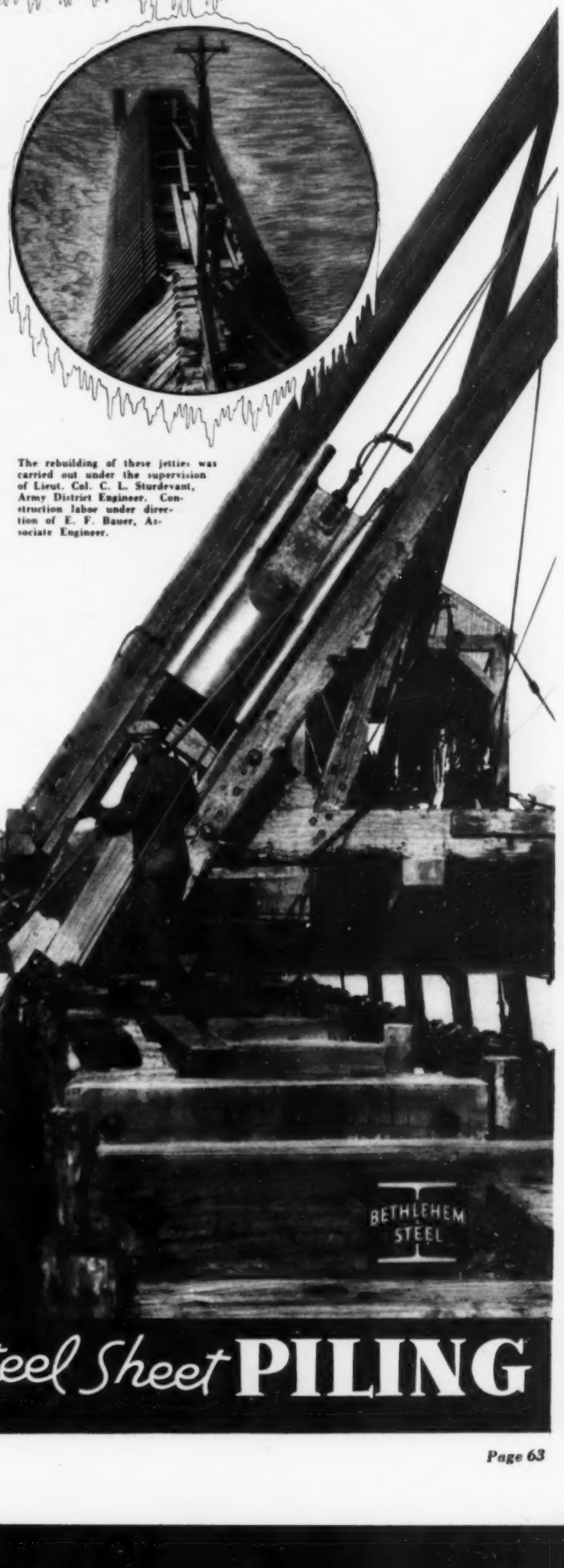
WHEN farthest Alaska lies in the grip of the long Arctic winter, dense ice floes, often several feet thick, form in Bering Sea. Moved by the action of wind and tide, these huge floes exert almost irresistible pressure, crushing and battering to destruction everything in their path.

To protect small boats, a refuge harbor and unloading basin was built at Nome, Alaska, in 1919 and 1920, by dredging a channel and constructing two short jetties of timber. The sides of the jetties were sloped to allow large ice masses to pass over them without damage.

Recently these jetties were rebuilt and enlarged. This time the material used was Bethlehem Steel Sheet Piling. The piling, in 34-ft. lengths, was driven at an angle of 34 deg. to the vertical, by a specially constructed pile driver. A minimum penetration of 14 ft. was attained, in hard gravel.

The reasons for the use of Bethlehem Piling for these unusual jetties were the same reasons that have led to its use on so many other projects: great strength, long life, low cost of maintenance.

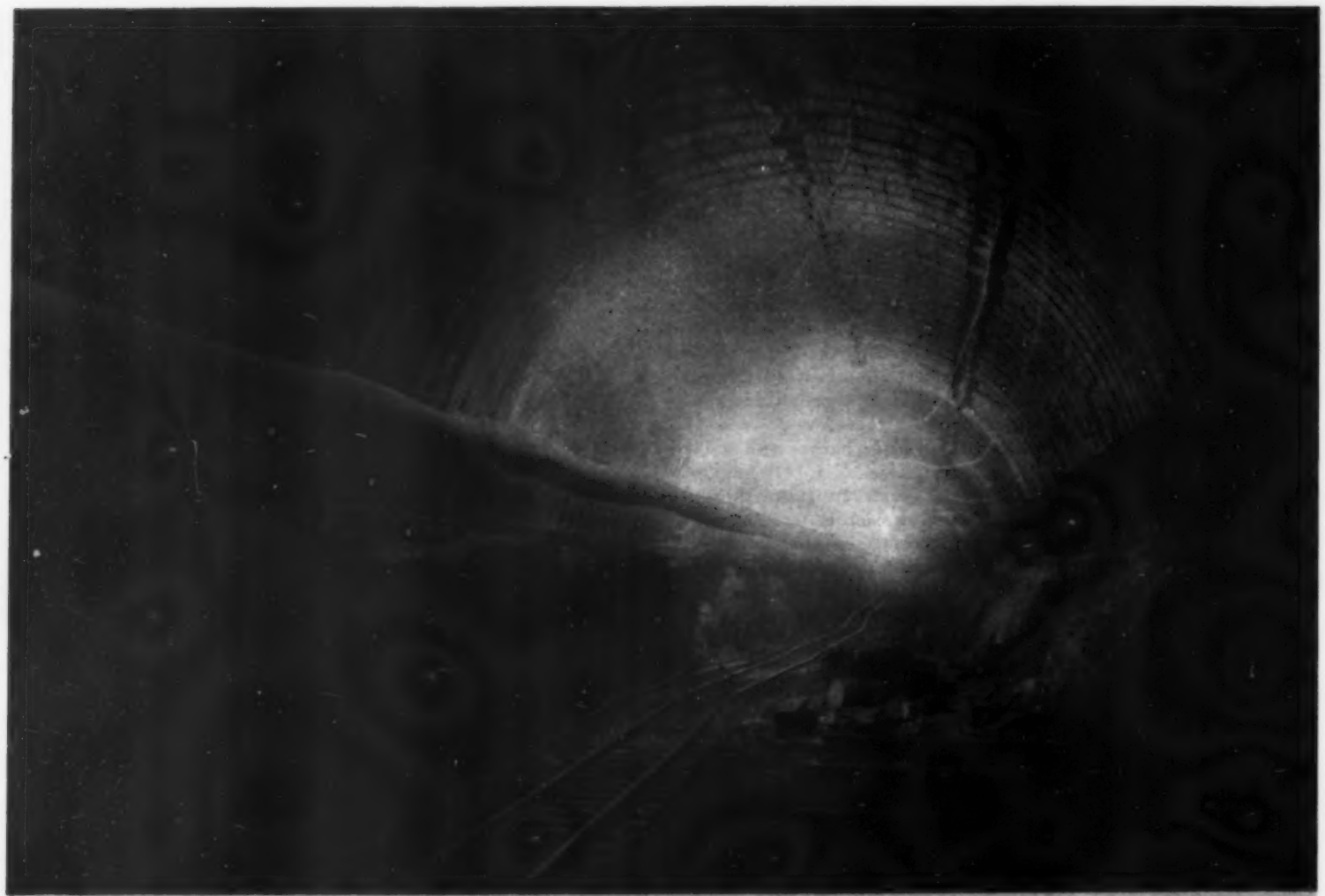
The job may be the protection of winter-marooned boats near the Arctic Circle from ice floes. Or the safeguarding of Florida beaches from tropical storms. Or the construction of a 100-ft.-deep caisson for a pier for the great San Francisco-Oakland bridge. Whatever or wherever the project, you can depend on Bethlehem Piling. In its use has lain the satisfactory and economical solution to many an engineering problem.



The rebuilding of these jetties was carried out under the supervision of Lieut. Col. C. L. Sturdevant, Army District Engineer. Construction labor under direction of E. F. Bauer, Associate Engineer.

KALMAN STEEL CORPORATION, *Subsidiary of Bethlehem Steel Corporation*, *General Offices:* Bethlehem, Pa. *District Offices:* Albany, Atlanta, Baltimore, Boston, Buffalo, Chicago, Cleveland, Cincinnati, Detroit, Houston, Milwaukee, Minneapolis, New York, Philadelphia, Pittsburgh, St. Louis, St. Paul, Syracuse, Washington. *Pacific Coast Distributor:* Pacific Coast Steel Corporation, San Francisco, Los Angeles, Seattle, Portland, Honolulu. *Export Distributor:* Bethlehem Steel Export Corporation, New York.

BETHLEHEM *Steel Sheet* PILING



WHEN AIR IS NEEDED

call on "Ventube"

Construction engineers working against time have learned that du Pont "Ventube" is the basis of the ideal ventilating system.

It is quickly installed. One man can hang 200 feet in an hour.

It delivers air with a minimum of loss and friction.

Ventube speeds up operations through the speed with which it can be brought up to the working face to clear away gases after blasting.

It is tough, durable, laboratory developed to serve under widely varying climatic conditions.

After use on a job, it can be rolled up and stored in small space.

Ventube has been used in tunnel driving the world over.

Competent advice on the use of Ventube will be given on request.

WRITE FOR SAMPLES, PRICES AND
BOOKLET ON TUNNEL VENTILATION
E. I. DU PONT DE NEMOURS & CO.
FAIRFIELD CONN.

DU PONT VENTUBE

wheat and cement

EVERY work day in the year hundreds of shipments of wheat of a given grade are sold on the Chicago grain market at a uniform delivered price.

This wheat of a standard grade comes from hundreds of farms scattered over a wide area, anywhere from a few to 500 miles away. Though raised at different costs, and shipped varying distances, it is all sold at the prevailing delivered price. Though all farmers are keen competitors of each other, their wheat must sell at the uniform going price.

There is an economic reason for this. Since all wheat of any standard grade is worth the same, no matter who has raised it or from where it has come, buyers will pay no more for wheat of this grade from one state, than for wheat of the same grade from another state. The same economic law determines the prices of sugar, or any other standard product.

Since cement is a standard product as uniform as wheat or sugar of any given grade, buyers at any point will buy it only from a cement plant that is quoting the lowest price. Other cement plants, no matter where located, must meet this lowest price if they want the business. The lowest price becomes the going price.

Since all or nearly all cement plants — like all or nearly all wheat growers — are located at varying distances from a given sales point, and must pay widely varying freight charges, they actually net different amounts at the mill door, just as farmers realize different nets at the farm. Just as the wheat grower farther away must take a lower net than the farmer in a nearby state, so must the cement plants further from a given point be content with a smaller net than the one obtained by the mill nearest the market.

Uniform portland cement prices in any town are as logical and inevitable as uniform wheat prices at the Chicago grain market. The cement business is as highly competitive as the grain business. The falling cement price curve from 1920 to 1932 is evidence of this.

THE CEMENT INSTITUTE

NEW YORK · CHICAGO · KANSAS CITY

GOING FORWARD WITH CEMENT

This is one of a series. Copies of previous advertisements will be sent on request

Contractors Rely on Inland Piling for Mississippi Waterway

NRA CODE

At Top—section of the cofferdam before filling. **At Right**—*some of the permanent piling with cofferdam in background. 3200 tons of Inland Piling used: Section I-23 for cofferdam, Section I-31 for permanent cut off walls.*

● Pictured above are views of one of the many lock and dam jobs on the great Mississippi River 9-foot channel project on which leading contractors have used Inland Steel Sheet Piling.

On this particular job, Lock No. 7, Dresbach, Minn., (also Lock No. 26, Alton, Ill.,) a new type of cofferdam construction, suggested by Inland, was used. This cellular type of cofferdam is braced with fabricated frames instead of the usual crosswalls of sheet piling, providing economy in steel and a construction capable of hydraulic filling, while retaining all the advantages of cellular construction.

Such helpful cooperation is always available from Inland. Write for the new Inland Sheet Piling Catalog No. 3. INLAND STEEL COMPANY, 38 So. Dearborn St., Chicago, Ill.

INLAND STEEL

ABLE SERVANT OF THE CENTRAL WEST

Sheets · Strip · Tin Plate · Plates · Structurals · Piling · Rails · Track Accessories · Bars · Rivets · Billets

FRANK T. SHEETS, for 9 years Chief Highway Engineer of the State of Illinois, now Consulting Engineer of the Portland Cement Association, is the author of *"Concrete Road Design."* Ten thousand miles of concrete roads were built on the Illinois State Highway System under his direction.

DR. MILLER McCLINTOCK, nationally known traffic expert, director of the Albert Russel Erskine Traffic Bureau of Harvard University, has prepared a companion book, *"Short Count Traffic Surveys."* He has been employed by Los Angeles, San Francisco, Chicago, Boston and other cities as the acknowledged authority in his line.

Sheets' Great Work aided by McClintock

"Short Count Traffic Surveys" supplements "Concrete Road Design"

HIGHWAY engineers have generally approved the recommendations of Frank T. Sheets that every road be designed to carry expected loads.

Now Dr. Miller McClintock, director of the Erskine Bureau of Street Traffic Research of Harvard University, has developed a system for making the necessary traffic forecasts accurately—yet quickly and at low cost. Dr. McClintock from his wide experience tells you:

1. How to make traffic surveys by the low-cost short count method.
2. How to present and interpret the data secured in such surveys in the form of accurate traffic forecasts.

When the highway engineer has this traffic forecast complete, he will find that *only with concrete* can he design a road with scientific precision to fit anticipated loads. Basic facts as to distribution and concentration of stresses, fatigue, etc., have not been developed for other materials.

A majority of highway engineers have written for Sheets' booklet "Concrete Road Design." Send this coupon for the new companion booklet—or for both.

PORTLAND CEMENT ASSOCIATION
Room 329, 333 West Grand Ave., Chicago

Please send me:

☐ Short Count Traffic Surveys by Dr. Miller McClintock.
☐ Concrete Road Design by Frank T. Sheets.

Name.....

Street.....

City.....*State*.....

Built Stronger For Rougher Usage

THE IMPROVED MODEL

of the

"FAVORITE" Reversible Ratchet WRENCH

Is Just The Tool For Contractors

on the nut-turning portion of the contract that must be speeded up

CADMIUM FINISH

BUILT OF A STRONG, TOUGH METAL

Works on a quick straight-ahead ratchet movement, and the socket form of head is not removed from the nut until operation is completed.

Can be used in narrower places than an ordinary wrench.

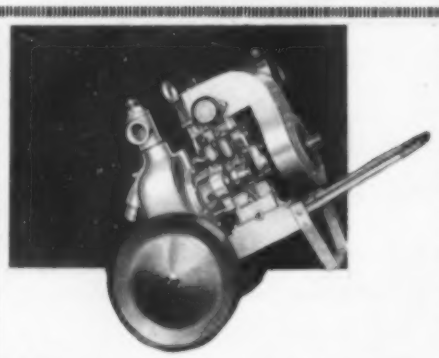
A TIME-SAVER

The design of the "Favorite" wrench is simplicity itself, having no complicated parts necessitating expensive machine work.

It is an efficient time-saving tool at a proper price.

Write for full particulars

GREENE, TWEED & CO.,
109 Duane St. New York
Sole Manufacturers



Primes at over 25 ft. lifts—without hand adjustment.

No hand adjustment for recirculation cut-off.

Compact, rugged — one moving part.

3 times bigger water passages.

GIANT CAPACITY, FASTEST 100% AUTOMATIC PRIME with JAEGER 2", 3", 4", 6", 8", PUMPS!

Self-cleaning shell.

Timken or ball bearings.

No shaft packing.

Capacities 10,000 to 125,000 g.p.h.

Write for Prices!

The Jaeger Machine Co.
800 Dublin Avenue Columbus Ohio

It is so simple and it will save you so MUCH MONEY to know your cable loads

Money saved when they are right, money wasted when they are wrong.

You can check the load on any line on the Job with a Martin-Decker, Shunt Type Tension Indicator, quickly and accurately, without dead-ending or cutting.

Two sizes—for cables ¼" to 2⅜" in diameter; loads up to 260,000 pounds.

Write for descriptive literature

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SEPTEMBE

What BOSO & RITCHIE *found out about the* NEW 1½ YD. LORAIN-77 DIESEL

★

GREATER SHOVEL OUTPUT

In gumbo digging, this Diesel Lorain averaged from 2600 to 3000 yds. in 14 hrs. daily—and has loaded as many as 190—8 yd. wagons in 4½ hrs.—or over 330 yds. an hour.

★

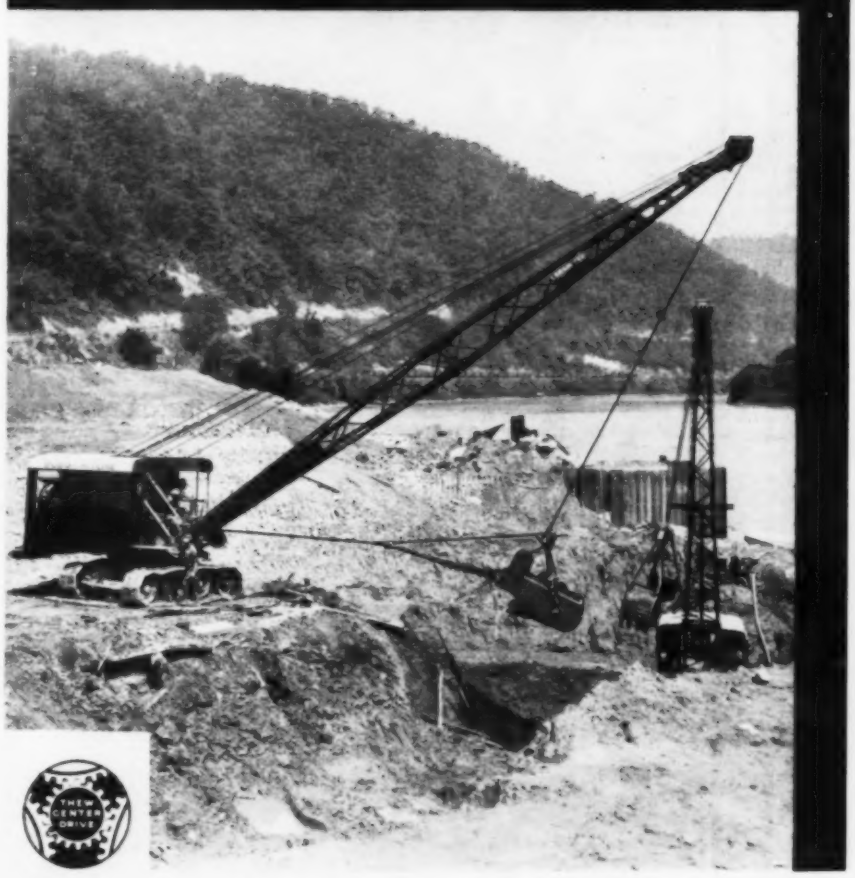
75% LESS FUEL COST

40 gals. of fuel oil keep this Diesel Lorain running 14 hrs.—at a cost of about $3.00—a gas machine on the same job uses $12.60 of fuel in 14 hours.

★

THE JOB . . . . . .

175,000 yds. to be excavated for the hydro-electric plant of the Kanawha Valley Power Co., at London Locks and Dam on the Kanawha River. Excavating Contractors, Boso & Ritchie, Ravenswood, W.Va., owners of 5 Lorains.



★

100′ DRAG CABLE MOVES 30,000 YDS.—STILL GOING

This same Diesel Lorain, as a dragline, is digging 30 ft. below its treads and is handling 1800 yds. in 14 hrs.—all loaded. Using a 100 ft. drag cable and a new style L-77 fairlead, it had moved (up to Aug. 8) 30,000 yds. and was still using the same cable.

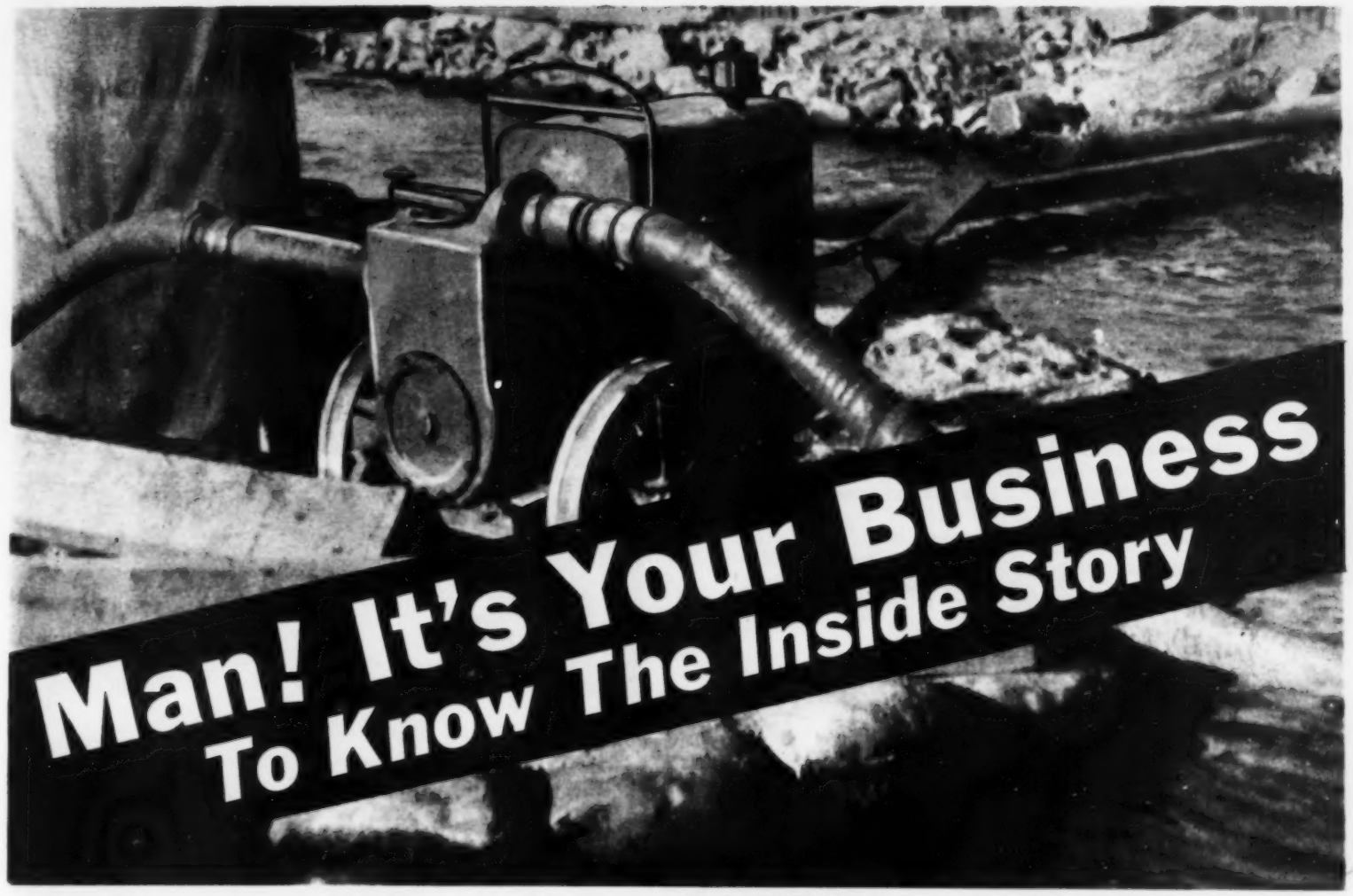
★

560 HRS. BEFORE REVERSING SWING BANDS FOR ADDITIONAL LIFE

After 560 hrs. of such big production, both as shovel and dragline, the L-77 new style 4½″ wide swing bands were reversed—not replaced—and are now expected to equal at least their initial service—and probably more.

★

THE THEW SHOVEL CO. • LORAIN • OHIO



on Self Priming Centrifugal Pumps

There are several good makes of Self Primers on the market. These makes are all built in uniform sizes. Their ratings and prices have become practically standard for all manufacturers on the various sizes.

WHAT'S THE DIFFERENCE IN THE NOVO INJECTO-PRIME PUMP.

NOVO Has No Valves

With this standardization of ratings and price, wouldn't you rather have a pump without valves, those trouble-making hangovers from the diaphragm pump? The Novo is the only exclusively contractors' pump that operates without the use of valves.

NOVO Has No Packing

Again assuming the standardization of self primers wouldn't you prefer a pump without packing? Novo has no packing. Two leather seals on the chrome plated impeller shaft sleeve make the seal.

Never has it been necessary to replace one of these seals during their years of service. Compare that with the daily and weekly adjustment and frequent replacement that conventional packing requires.

NOVO Has MORE POWER

Going back to our original assumption, isn't a pump powered with an engine that has surplus power and efficient water cooling going to give the greatest satisfaction? The Novo pump has the largest, most powerful engine on all sizes straight through the line. Rated horse powers are developed at 200 to 600 R.P.M. slower speeds than other engines.

SIZES

2 In.
10,000 gal. per Min.

3 In.
20,000 and 24,000 gal. per Min.

4 In.
40,000 gal. per Min.

6 In.
90,000 gal. per Min.

Fig. 1703
Novo 3 in. Injecto Prime self primer — 2 capacities 20,000 and 24,000 GPH

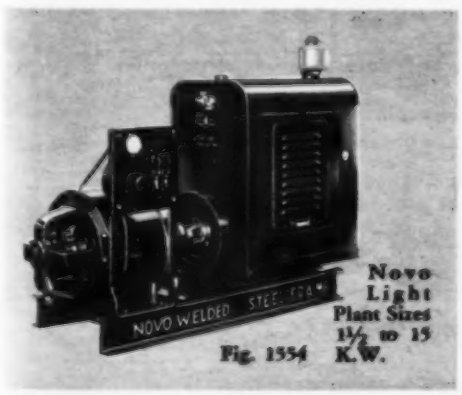


Fig. 1554 Novo Light Plant Sizes 1½ to 15 K.W.

Light for night work

Novo Light Plants give you flickerless, dependable light all night long at a cost of only a few cents per hour.

NOVO BUILDS PUMPS
HOISTS • LIGHT PLANTS
AIR COMPRESSORS

NOVO

THIS COUPON BRINGS THE DETAILS YOU WANT

NOVO ENGINE COMPANY,
214 PORTER ST.,
LANSING, MICHIGAN

I've checked below the printed matter to send me. Please send it to

Name ..... **Address** .....

- ☐ Novo Self Priming Centrifugal Pumps: 2"☐, 3"☐, 4"☐, 6"☐.
- ☐ Novo Pressure Pumps.
- ☐ Novo Diaphragm Pumps.
- ☐ Novo Flud-Lite Lighting Units.
- ☐ Novo Dragline and Slackline Excavating Hoists.
- ☐ Novo Hoists.

YARDAGE RECORDS IN EVERY CASE!

WHETHER it's along the Mississippi, the largest levee yardage job ever conceived—or building a new path for a great river—or on small jobs where the machine moves forward almost constantly—You'll find Bucyrus-Monighan Walkers consistently adding new laurels to their long-established reputation for piling up yardage records.

Pictured here are but a few of the Walker's varied tasks which include: Drainage Work; Hydro-Electric Development; Levees and Embankments; Reservoirs and Dams; Railroad Embankments; Sewer and Pipe Line Trenches; Coal, Gravel and Quarry Stripping and Excavation; Channel Changes, etc.—its adaptability is limitless. Bucyrus-Monighan Company, Chicago, Ill.

BUCYRUS MONIGHAN

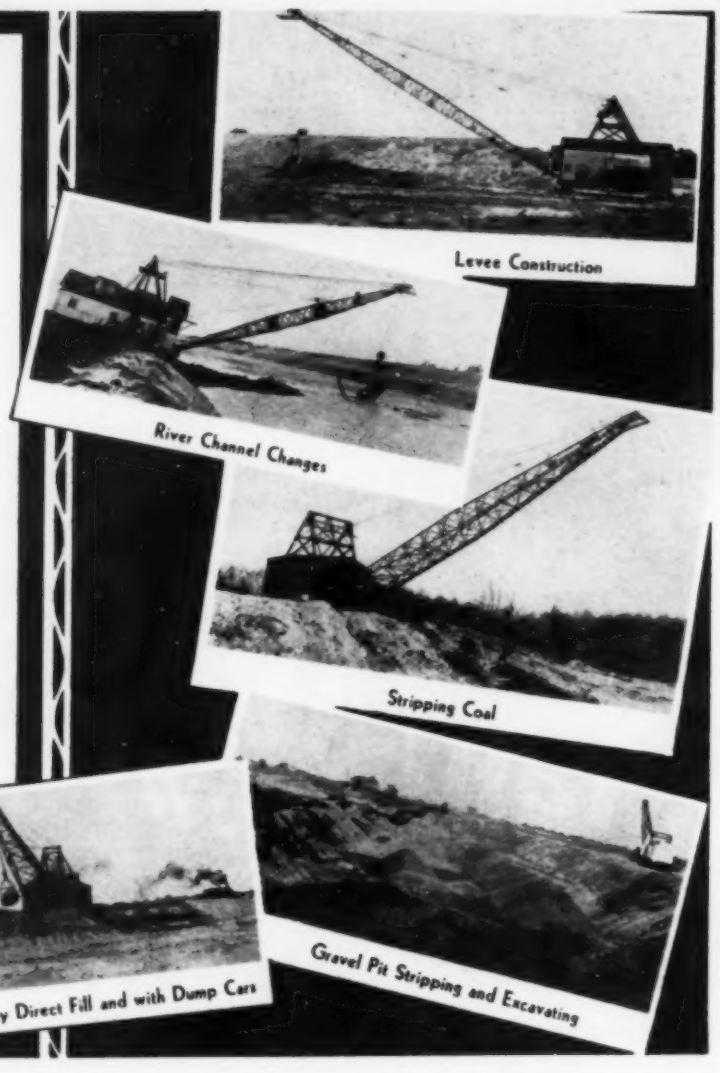
Walking Draglines 1 to 10 cubic yards

Sold by

BUCYRUS-ERIE COMPANY

South Milwaukee, Wisconsin

Representatives throughout the U. S. A. Branch Offices: Boston, New York, Philadelphia, Birmingham, Chicago, Pittsburgh, St. Louis, Kansas City, Dallas, San Francisco. Offices or Distributors throughout the world. B-61



Levee Construction

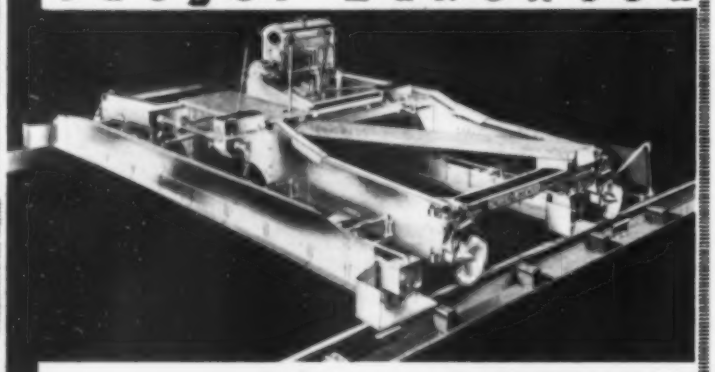
River Channel Changes

Stripping Coal

Building an Embankment by Direct Fill and with Dump Cars

Gravel Pit Stripping and Excavating

Jaeger-Lakewood



Automatic Finisher

for both bituminous and concrete, produces smoother pavements at lower cost because it combines

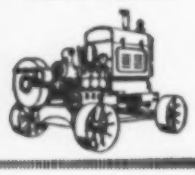
Gas or Gas-Electric

drive with higher speeds, automatic power lift and 12" box-type screeds that operate

with Velvet Touch

Numerous other improvements. Write for catalog, prices, to The Jaeger Machine Co., 800 Dublin Ave., Columbus, Ohio.

ROAD PUMPS



ROAD FORMS

VIBRO-SPREADERS
SUB-GRADERS
GRADE ROOTERS

BRIDGE BUILDER'S MIXERS

2 MODEL 38—1/2 yd. Heavy Duty BAY CITY'S

for

WEST VIRGINIA STATE HIGHWAY DEPARTMENT

Last month, we told you of the eight Bay City Shovels, *on the job* for Michigan County Road Commissioners. Now we can tell you of two ½ yd., heavy-duty, Model 38, Bay-City's that are being used down in Elkins, for the West Virginia State Highway Dept. Bay-City Shovels, available in capacities of ⅜ yds. to 1¼ yds. are piling up performance records that are hard to beat — they are *returning profits* to users all over the country.

And when Bay-City users become Bay-City boosters, you can bet they come back with repeat orders—putting more Bay-City's *on the job*. If you have not watched a Bay-City in action recently, write us for reasons why you should use a modern Bay City on your next job.

BAY-CITY SHOVELS Inc.

BAY CITY, MICH. U.S.A.

Don't take our word for it!

Read this

TEST REPORT on NATIONAL CARBIDE V-G LIGHTS

PITTSBURGH TESTING LABORATORY
PITTSBURGH, PENNA.

ORDER No. NZ-10[illegible]94
CLIENT'S No.

REPORT

LABORATORY No. 1[illegible]
FILE No. 8883.1
March 31, 1934.

SUMMARY
OF
TESTS OF NATIONAL CARBIDE V-G LIGHT
FOR
NATIONAL CARBIDE SALES CORP.
NEW YORK

Using a lamp obtained from the Pittsburgh office of the National Carbide Sales Corp., it was found:

1. That it would burn 12 hours at full intensity with 7 gallons of water and 7 pounds of carbide.
2. That it could be moved about and even tipped over while burning without going out, if righted and the control lever operated.
3. That is produced a light of about 8000 candle power, measured at the axis of its beam.
4. That it produced sufficient illumination for outdoor (rough) construction work over an area of about 8000 square feet - 0.2 foot-candles and up. Printing 1/8 inch high on white paper was legible 450 feet from the lamp if held at right angles to the axis of the beam.
5. That it could be operated intermittently without reduction in intensity or increase in carbide consumption.

Respectfully submitted,
PITTSBURGH TESTING LABORATORY
M. L. Carr
Director.

MLCarr:C

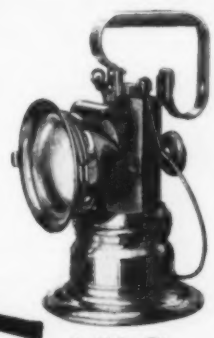
X-100
National Carbide V-G Light

NOTE in particular that *one* National Carbide V-G Light will adequately light up about 8000 square feet for profitable night construction work — that's real economy and efficiency!

Remember, there's a National Carbide Light for every purpose — plus National Carbide in the RED DRUM, available through our Warehouses and Distributors from coast to coast. Details?

NATIONAL CARBIDE SALES CORPORATION

LINCOLN BUILDING NEW YORK
Opposite Grand Central



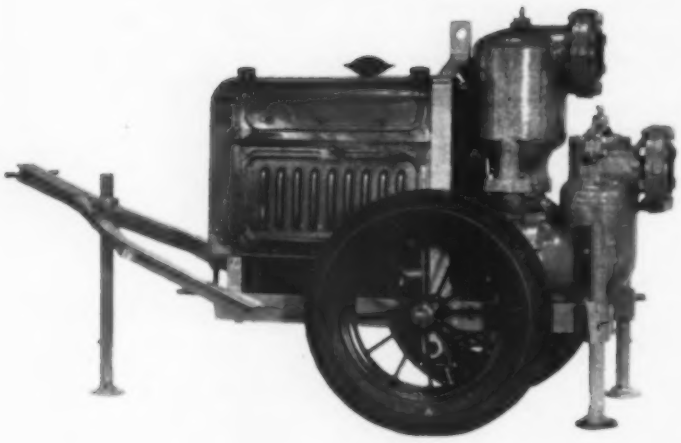
WL1-C1
NATIONAL CARBIDE LANTERN

Burns 8 hrs. on 8 oz. of Carbide. Brilliant rear signal of red, blue or green, no extra charge . . . Ideal for emergency lighting on road at night.

Y-199
NATIONAL CARBIDE V-G HANDY LIGHT

Burns about 5 1/2 hours on 1 3/4 lbs. of 14-ND Carbide, 2 gals. water; delivers about 1500 c. p. Weighs 37 lbs. charged—easy to carry, handy in emergencies.

Pump More Water for Less Money with LABOURS



From the standpoint of price, the only reasonable way to measure the cost of a pump is in terms of the number of gallons it will pump per dollar of operating and depreciation expense. When price is thus calculated, LaBour self-priming centrifugal pumps are lowest in the field.

The honest capacity and remarkable efficiency of LaBour pumps plus their simplicity and the inbuilt stamina which reduces repair costs and shut-down time to a minimum, are responsible for this record. More years of useful life with less expense are the premium that goes with the purchase of a LaBour contractors' pump.

We shall be glad to send you a copy of our LaBour Bulletin No. 41 in which the various types and sizes of LaBour pumps for contractors' service are illustrated and described. Send for your free copy today.

The LABOUR CO., INC.
909 Sterling Ave.
ELKHART, IND.

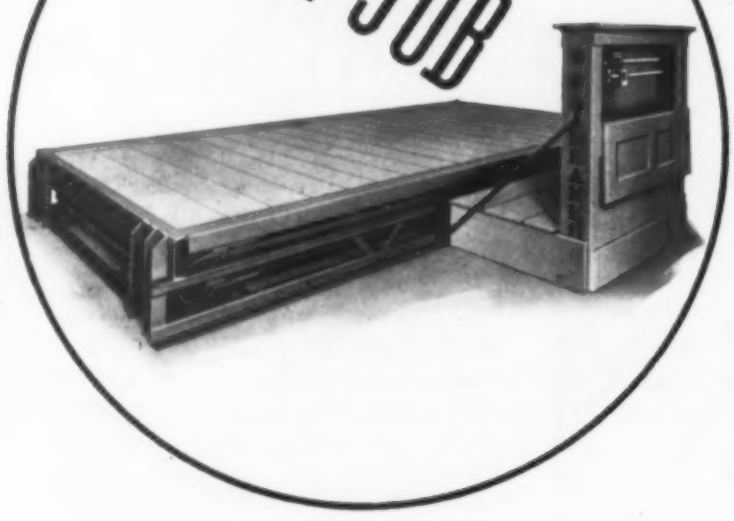
The MICHIGAN Truck-CRANE *speeds* to the job—

The Michigan Truck Crane is a triumph of modern engineering. It is uniquely designed to meet the great demand for a modern power crane that travels rapidly under its own power from one place to another. It gives the contractor and road builder a tool with which he may efficiently handle jobs which are too large to shovel by hand and too small to employ the use of a larger, more cumbersome and less mobile crane. And for snow removal, just the thing!

Write for details, no obligation.

MICHIGAN POWER SHOVEL CO.
BENTON HARBOR, MICH.

A Truck Scale you can .. TAKE TO THE JOB



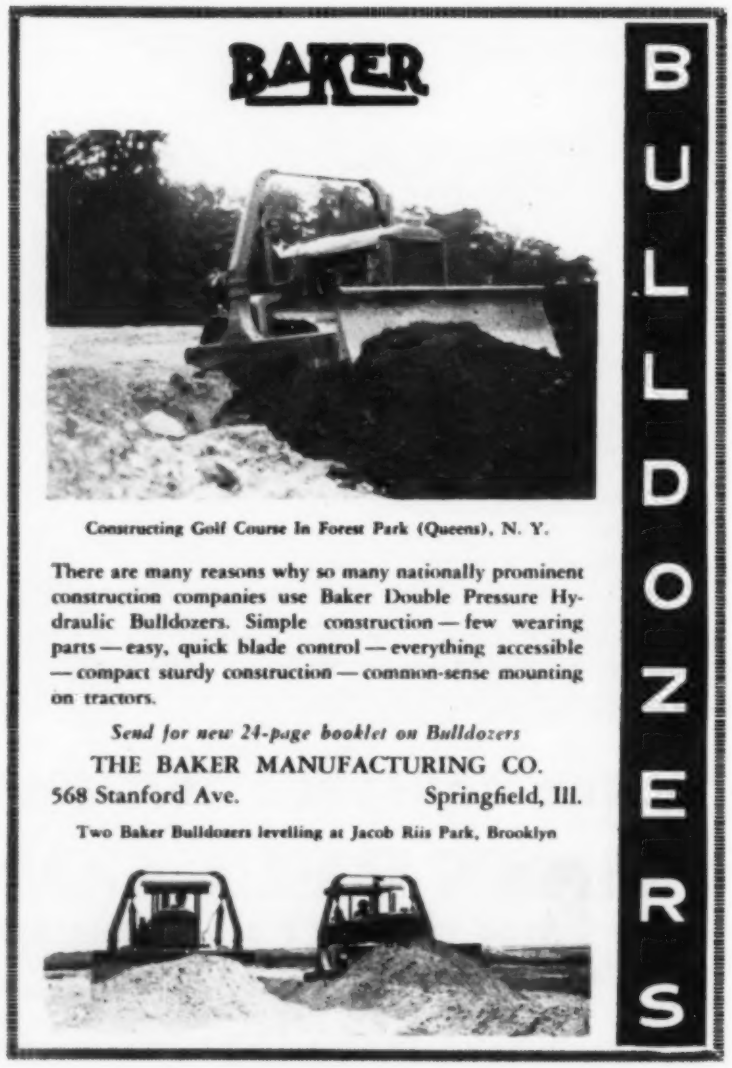
Again, Fairbanks, by closely watching the needs of the industries it serves, produces a scale which fits exactly the requirements of contractors.

For checking receipt and disbursal of aggregates—for weighing aggregate as a basis of payment for the job (a growing practice in many states)—Fairbanks has produced a self-contained Truck Scale which can quickly and easily be dis-assembled and transported from job to job. On a paving project, for example, this scale can be advanced along the job with the mixers or pavers.

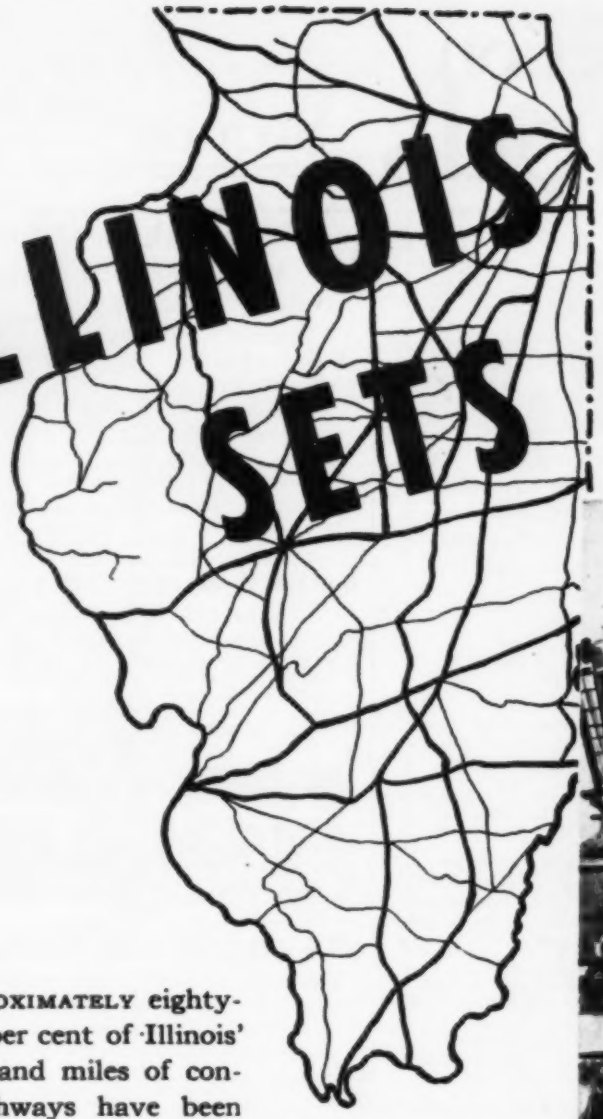
Full discriptive literature may be obtained by writing nearest branch, or Fairbanks, Morse & Co., 900 S. Wabash Ave., Chicago, Ill. And 40 principal cities—a service station in each house.

Fairbanks Scales

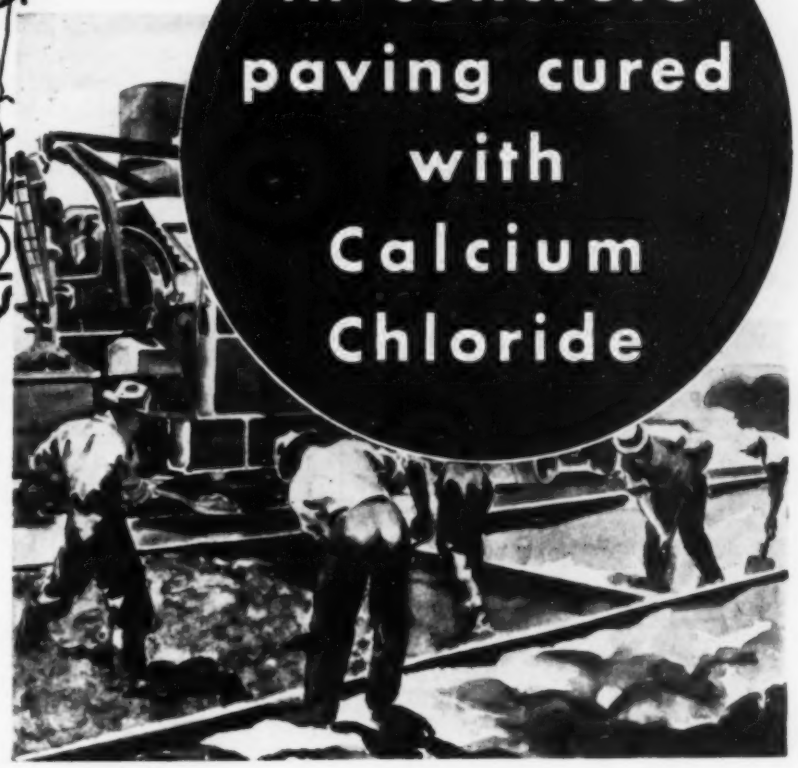
6186-SA31.14



ILLINOIS SETS THE PACE



in concrete paving cured with Calcium Chloride



● APPROXIMATELY eighty-five per cent of Illinois' ten thousand miles of concrete highways have been cured with Calcium Chloride. This huge mileage, plus the many years of experience attending its construction, has given Illinois highway engineers opportunity without limit for studying the effects of the various methods of curing . . . and particularly of the Calcium Chloride method. That Calcium Chloride curing is now used almost exclusively by this State speaks for the findings in unmistakable terms.

In many other States, too, extensive test and use amply support the practice and claims of scientists, research engineers, cement and concrete experts, and road-building engineers—that Calcium Chloride curing:

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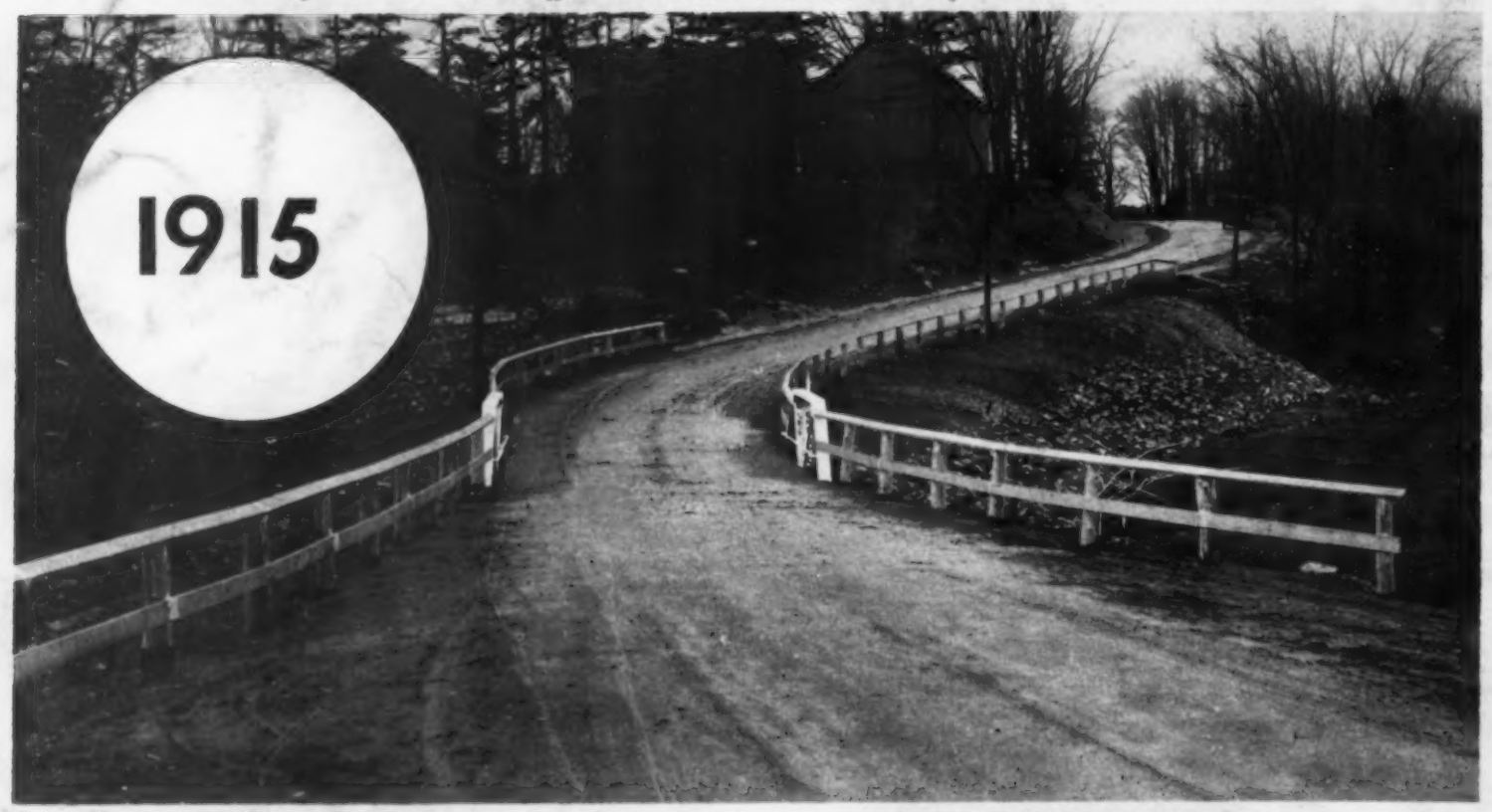

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